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Combined 1st & 2nd Quarterly Circulars for 1947

RUBBER RESEARCH SCHEME
CEYLON

July, 1947

H. W. CAVE & CO. LTD., COLOMBO.

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NOTICES

DARTONFIELD ESTATE — VISITORS' DAY

The services of technical officers are available to visitors on the second Wednesday in each month; the estate superintendent is available every Wednesday. Visitors are requested to arrive on the estate not later than 9-30 a.m.

Visitors will be welcomed at the station on other days provided an appointment has been made in advance.

Dartonfield Estate is situated about 3½ miles from the main Matugama-Agalawatta Road, the turn-off being near culvert No. 14/10. The distance from Colombo is approximately 47 miles.

PUBLICATIONS

Rubber Research Scheme publications comprising Annual Reports Quarterly Circulars and occasional Bulletins and Advisory Circulars are available without charge to the Proprietors (resident in Ceylon), Superintendents and Local Agents of Rubber estates in Ceylon over 10 acres in extent. Forms of application for registration may be obtained from the Director. Extra copies of publications can be supplied to the Superintendents of large estates for the use of their assistants.

ADVISORY CIRCULARS.

The undernoted Circulars may be obtained on application at 25 cents per copy. Future issues in the series will be sent free of charge to estates registered for the receipt of our publications :—

(1) Notes on budgrating procedure (revised June, 1943).
(3) Notes on Rubber seedling nurseries. (Revised September, 1943).
(4) Contour lining holing and filling, cutting of platforms, trenches and drains (revised June, 1943).
(5) Straining box for latex (January, 1940).
(6) Notes on the care of budded trees of clone Tjirandji 1 with special reference to wind damage (September, 1938).
(8) Planting and after-care of budded stumps (revised June, 1943).
(10) Root disease in replanted areas (August, 1939).
(14) Rat Control (September, 1940).
(16) Increasing the crops from Ceylon Rubber estates (January, 1942) and two Supplements.
(17) Tapping young budded trees (May, 1942) and two Supplements.
(18) Rubber manuring under wartime conditions. (November, 1942).
(19) Density of Planting and Thinning-out, (December, 1942).
(20) Planting material recommended for use (1944). (Revised May, 1944).
(21) The Control of Bark Rot and Canker. (April, 1944).
(22) Oidium Leaf Disease. (April, 1944) and two Supplements.
(23) Uniformity in the Nomenclature of Clones and Clonal Seedlings. (December, 1944).
(24) Treatment of Brown Bast. (December, 1944).
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YIELDS OF BUDDED RUBBER AND CLONAL SEEDLINGS IN COMMERCIAL TAPPING

C. A. de SILVA, *Botanist*

In the *Combined Third and Fourth Quarterly Circulars* for 1945, the first of a series of reports was published by C. C. T. Sharp, Botanist, to take the place of previous articles on "The Performance of Imported Clones in Ceylon" appearing in the *Quarterly Circulars* for 1943, page 15 and 1944, page 15.

The yields for 1945 have been received in response to a fourth questionnaire sent out to estates through their agents. Owing to an acute shortage in staff, the despatch of the last questionnaire was considerably delayed and the collation of yields from the various estates was carried over well into 1947. Yield results from 66 estates with a total acreage of over 5,000 acres have been examined. Unfortunately a considerable part of this acreage was made up of polyclone blocks, from which yields were not recorded for individual clones.

Yields from Older Clones.—TJ. 1, TJ. 16, BD. 5, BD. 10, AV. 49 and AV. 50. As presented for 1944 the yields from older clones are summarised in Table I, comparing the results within estates with more than one of these clones in tapping. Fields of less than 5 acres have been rejected and the intensity of tapping has been limited to 100 per cent, except where it is indicated in the Table, 70 trees to the acre has been fixed as a minimum except for the 1st tapping year in which a somewhat smaller number of trees has been passed in a few cases to provide a better picture of continuity in yields.

Too much reliance must not be placed on any one comparison for soil conditions will vary from field to field. Comments are made on a fairly general comparison of all the records taken together and the writer's experience of the performance of the clones in field experiments at Dartonfield and elsewhere.

While keenly appreciating the difficulties of estate staffs in sending us the results from year to year, it is to be regretted that some records had to be discarded owing to changes in information with regard to acreage, names of clones and systems of tapping sent in for the same clearings in 1945. With improvements in staff both in the Scheme and on estates, it is hoped that a number of these anomalies referred to will be straightened out by subsequent correspondence in 1947. In the meantime Estates Nos. 690 and 01 have been deleted from Table I. It has also been necessary to make a few changes in acreages and yields already published.

Clone TJ. 1.—This clone remains the most reliable high-yielding clone under various climatic conditions. On Estates Nos. 284 and 688, a serious deterioration in yield has set in due to an effort to increase yields by introducing the double-three tapping system or by tapping on extra days, resulting in the inevitable change to a less intensive system on the incidence of Brown Bast. It can be definitely stated that all evidence so far available shows that the double-three system is unsuitable for high-yielding clones at least during their first 10 years of tapping. It is felt that

there has been a tendency in the past, partly due to the war effort, to reach the 1,000 lbs. per acre level before the normal yielding capacity of the clones permits it.

It must be remembered that individual tappers have many ways of "bleeding" the trees apart from yields obtained from the set intensity of tapping. Indiscreet goading of tappers to bring in increased crop may result in a serious setback in the yields of young budded clearings.

In Malaya where conditions for growth are more favourable, it is quite possible that trees can reach the 1,000 lbs. level much earlier than in Ceylon. It has been proved from reliable evidence that yield is obtained at the expense of growth; this is more marked during the first three to four years of tapping. It is, therefore, necessary to postpone the introduction of the higher yielding double-cut or full spiral systems of 100 per cent intensity, until the rate of growth of young budded trees becomes a less important factor.

The fact that clone TJ. 1 has given yields in excess of clone BD. 5 on Estate No. 822 in the first and second tapping years, confirms the view that this clone is suitable for the drier districts of Ceylon. The marked drop in yield of clone TJ. 1 in the dry months is more than compensated for by its total yield for the tapping year.

Clone TJ. 16.—The yields of this clone are on the whole lower than those of TJ. 1. Reports of the susceptibility of TJ. 16 to severe attacks of Oidium leaf disease, continue to come in, due to its late wintering habit. It is interesting to note the high yields obtained on Estate No. 168 in the Kurunegala district without any special comments on Oidium. Reports from other plantations in the same district tend to confirm this impression and they stress the necessity for estates to try out the high yielding clones on a small scale, with a view to increasing the acreage of any clone that does particularly well under local conditions.

Clone BD. 5.—This clone compares very favourably with TJ. 1 and has on many estates given good yields, usually rather lower than TJ. 1. BD. 5 has a number of poor secondary characters, especially dieback of young stems due to Phytophthora, which in some districts causes a severe setback in growth and often forms a source of infection to less susceptible clones in the early stages of growth.

AVROS. 49 and 50.—In general the potentialities of these clones are below those of TJ 1. The yields are extremely variable and have not reached the 1,000 lb. per acre level on any estate under conditions in Ceylon.

Clones GL. 1, PB. 86, PB. 186, HC. 28 and HC. 55.—Early yields of these clones have been sent from a few estates and the information is summarised in Table II. A few figures published in 1945 have been adjusted owing to alterations in the original information sent in the 1944 returns. On Estate No. 141, clone PB. 86 turns out to be clone PB. 186.

Clone Glenshiel 1.—Although a less vigorous grower than clone TJ 1 it has a high-yielding capacity per tree. Two estates have already reported a fairly high percentage of Brown Bast cases before the end of the third tapping year. Our own experience has been that after 3 years tapping on 100 per cent intensity, the incidence of Brown Bast can be both sudden and serious. Our present recommendations are that the S/2, d/3, 67% tapping system should be adopted for the first three years before considering the higher intensity of 100 per cent on S/2, d/2. The present indications are, that the yields obtained on 67 per cent intensity are over 900 lbs.

per acre in the 5th year of tapping and the lower intensity may well be adopted as a permanent tapping system for this clone. Reports of attacks by "Flying foxes" on GL 1 foliage turn out to be both regional and seasonal and do not warrant a change in our present recommendations of planting the clone on a large scale. A note of warning has been given about the high incidence of Brown Bast in a supplement to our Advisory Circular No. 20, but with careful tapping as recommended, this apparent defect can be greatly minimised.

Clone PB. 86.—The yields of this clone compare very favourably with those of GL. 1 and TJ. 1. The early yields at Dartonfield are very promising and the clone can be recommended with increased confidence. It appears to be less susceptible to Oidium leaf disease than TJ. 1 and GL. 1 and should prove suitable for most districts.

The poorest soils are generally unsuitable for clones GL. 1 and PB. 86.

Clone HC. 28—is still recommended for small scale planting. It has yielded somewhat less than TJ. 1 on 2 estates, but the acreage of this clone can be profitably increased, after conditions of early Brown Bast and the difficulty of tapping on its fluted stem have been tested out on any particular estate.

Clones HC. 55 and PB. 25—are no longer recommended for use.

Clonal seedlings.—The early yields from commercial areas planted with Prang Besar Isolated Garden seed continue to be very promising. These are summarised in Table III according to the year of tapping, and comparison is made with fields of about the same age, growing on the same estate. In most cases the seedlings have given yields higher than those from budded rubber areas of approximately the same age. This is partially due, in the early years, to the fact that seedlings girth quicker than budded trees. Unfortunately the potentialities of clonal seedlings have not been fully exploited on most estates, by an oversight in not adopting a high density initially and later thinning out on qualities of growth, yield and disease; these recommendations have been clearly set out in our Advisory Circular No. 19.

Our experience has been that seedlings are as susceptible to Brown Bast as budded plants, and that there is a need for a better knowledge of the various "types" of clonal illegitimate seed, which are available in Ceylon and elsewhere at the present time. Apart from the composition of a seed garden it is essential that each garden should build up a reputation for itself, based on the performance of its production, before large scale planting can be adopted with any confidence. Meanwhile it can be stated that the planting of seedling material is becoming increasingly popular in Ceylon and a note of warning should be sounded that unless the correct procedure of planting and thinning out is adopted, with a clear knowledge of the material which is now being planted, there is little chance of it coming up to the standard of the better known high-yielding clones of budded Rubber, and a good few may be disappointed in the future.

TABLE I

Yields of Clones in Commercial Tapping—Age in Years

Estate No.	District	Clone	Acres	6 Yield	6 %	7 Yield	7 %	8 Yield	8 %	9 Yield	9 %	10 Yield	10 %	11 Yield	11 %	12 Yield	12 %	13 Yield	13 %	14 Yield	14 %	15 Yield	15 —	16 Yield	16 —
822	Passara	Tj. 1	26																	811	100	818	100		
		B.D. 5	26																	581	72	520	64		
284	Kalutara	Tj. 1	19-273	382	100	556	100	732	100	798	100	944	100	1050	100	1130	100								
		Tj. 1	61-203									*768	81	* 877	84	* 708	63	*663		*643					
		Tj. 16	9-62	154	40	281	51	400	55	575	72	522	81	556	53	* 513	45								
		B.D. 5	42-102					430	59	674	84	844	89	1073	102	1152	102	1298							
		AV. 50	22					316	43	608	76	617	65	715	68	716	63								
		PB. 25		448	117	391	70	523	71																
350	Kalutara	Tj. 1	10	346	100	582	100	608	100																
		Tj. 16	10	319	92	567	97	645	106																
		B.D. 5	10	348	100	528	91																		
		BD.. 10	10			566	97	617	101																
218	K. V.	Tj. 1	8									777	100	866	100	1052	100	1010	100	1042	100				
		B.D. 5	7									741	95	817	94	1080	103	766	76	943	90				
		B.D. 10	8									872	112	943	109	1090	104	851	84	975	94				
		AV. 50	5									475	61	648	75	880	84	743	74	764	73				
688	Ratnapura	Tj. 1	21-81							289	100	359	100	511	100	667	100	821	103	660†	100	504 †			
		TJ. 16	66									218	61	306	60	266	89	350	43	324	49				
		B.D. 5	70							200	69	378	105	472	92	446	67	488	59	373†	56				
		AV. 50	21-61							442	153	503	140	607	119	711	106	703	86	377†	57				
128	Kegalle	Tj. 1	43-65	416	100	662	100	898	100																
		Tj. 16	25	258	62	428	65	568	63																
316	Hapugas-tenne	Tj. 1	7-8											394	100	616	100	748	100	821	100	886		1040	
		Tj. 16	22							630		519		593	150	657	107	548	73	621	76				
166	Kalutara	Tj. 1	61	506	100	526	100																		
		B.D. 5	25	329	65	462	88																		
26	K.V.	Tj. 1	29			433	100	665	100																
		B.D. 5	24			554	125	800	120																
153	Kalutara	Tj. 1	31	387	100	537	100	743	100																
		B.D. 5	19	371	96	466	87	782	105																
476	Galle	Tj. 1	11-22					346		512	100	591	100	732		*1112									
		AV. 49	9							440	86	696	117*												
546	Kegalle	Tj 1	11			495	100	777	100	898	100														
		AV. 49	7			504	101	642	83	623	70														
168	Kurunegala	Tj. 16	5					829	100	982	100	1225	100	1147	100	969	100	685	100						
		AV. 49	6					601	72	624	63	994	81	814	71	851	88	524	76						

* Reduced intensity to 67% owing to Brown Bast.

† Reduced intensity to 100% from 133%

TABLE II

Yields of Clones GL. I, PB. 86, HC. 28 & 55. PB. 186

Estate	Clone	Acres	Trees per Acre		Yield in lbs.									
					6 years		7 years		8 years		9 years		10 years	
			Total	No. of trees Tapped	Per acre	Per tree	Per acre	Per tree	Per acre	Per tree	Per acre	Per tree	Per acre	Per tree
141	GL. 1	19	140	36—125	184	5·1	502	4·0						
	P.B. 186	2	147	87—116	369	4·2	610	5·3						
	Tj. 1	25	140	58—118	225	3·9	447	3·8						
546	GL. 1	1·5	144	126—127	299	2·4	377	3·0	822	6·5				
	PB. 86	1	129	118—119	497	4·2	817	6·9	747	6·3				
	Tj.1	11	141	133	495	3·7	777	5·8	898	6·7				
172	GL. 1	9	158	91—112			330	3·6	925	8·2				
	Tj 1	22	119	90—97			259	2·9	554	5·7				
350	GL. 1	10	117	95—117			658	6·9	710	6·1				
	Tj. 1	10	117	96—99			582	6·1	608	6·1				
	Tj. 16	10	117	102—99			567	5·5	645	6·5				
350	PB. 86	10	120	101—101	407	4·0	549	5·4						
	Tj. 16	10	116	99—99	392	3·9	544	5·4						
	Tj. 16	10	117	102			567	5·6	645	6·4				
153	HC. 28	5	144	129—130			401	3·1	563	4·3				
	Tj. 1	21	128	115—117			583	5·1	838	7·2				
152	HC. 28	14	99	91—96					527	5·8	589	6·5	784	8·2
	HC. 55	3	89	71—74					328	4·6	467	6·6	577	7·8
	Tj. 1	8	108	100—96					544	5·4	727	7·3	841	8·7
107	GL. 1	7	111	73—29	479	6·6	439	15·0*						
	TJ. 1	79	123	115—93	473	4·1	610	6·6						

* Trees under 21 ins. girth stopped in 2nd tapping year, per tree yield based on 29 trees only.

TABLE III

Yield of Prang Besar Isolated Garden Seedlings Tapping System S/2, d/2, 100%

Estate Number	Acres	Date of Planting P. B. Seedlings	Date budded in field (F) or planting Budded Stumps (S)	Control Clone	Yield in pounds: 1st Tapping Year: Age in years	1st Tapping Year: No. trees tapped	1st Tapping Year: Per acre	1st Tapping Year: Per tree	2nd Tapping Year: No. of trees tapped	2nd Tapping Year: Per acre	2nd Tapping Year: Per tree	3rd Tapping Year: No. of trees tapped	3rd Tapping Year: Per acre	3rd Tapping Year: Per tree
	3	6/38			5¾	148	548*	3·7	141	807	5·7			
613	7		6/38 S	TJ. 1	5¾	—	462*		130	641	4·9			
	5	1/39			5¼	183	541	2·9	154	801	5·2			
166	25		6/38 S	TJ. 1	5½	88	547	6·2	112	603	5·4			
	5	6/38			5¾	157	507*	3·2	154	815	5·3			
152	5		6/38 S	PB. 25	5¾	92	251*	2·7	124	446	3·6			
	13	6/38			5¾	57	465*	8·1	85	812	9·6			
153	23	6/39			5¾	72	549*	7·6						
	21		10/37 F	TJ. 1	5¾	115	412*	3·5	115	583	5·1	117	838	7·2
	10		6-12/37S	TJ. 1	5½	101	333*	3·2	101	440	4·4	103	643	6·2
	10½	6/38			5¾		251*		95	524	5·0		782	
220	19		6/38	TJ. 1	6¾	67	319*	4·8		518				
	55½	5/40			6	106	434*	4·1						
107	78¾		5/39	TJ. 1	6	115	474*	4·1	92†	610	6.6			

* Yields from March to December only.

† Tapping discontinued on trees less than 21 inches girth.

FIELD EXPERIMENTS ON DARTONFIELD ESTATE—XXX

COMPARISON OF TAPPING SYSTEMS.

C. A. de SILVA, *Botanist*

The tenth and final year of experimental tapping was completed in February, 1947. Comments on the results of individual tapping years and cumulative summaries will be found in the publications given under. In this paper some of the more important experimental details are recalled and the cumulative results over the 10-year cycle, which afford a more reliable guide to the relative yields of the various tapping systems are finally discussed.

1. *Second Quarterly Circular for 1939*, Vol. 16, Part 2.
2. *Third Quarterly Circular for 1940*, Vol. 17, Part 3.
3. *Third Quarterly Circular for 1941*, Vol. 18, Part 3,
4. *Combined Quarterly Circulars for 1942*, Vol. 19, Parts 1-4.
5. *Combined Quarterly Circulars for 1943*, Vol. 20, Parts 1-4.
6. *Combined Quarterly Circulars for 1944*, Vol. 21, Parts 1-4.
7. *Combined First and Second Quarterly Circulars for 1945* Vol. 22, Parts 1-4.
8. *Combined Quarterly Circulars for 1946*, Vol 23, Parts 1-4.

Experimental Details

THE experiment was carried out in fields Nos. 3 and 6 on mature seedling Rubber at Dartonfield. The two fields were planted in 1917 and 1913, respectively and the yields averaged about 600 lbs. per acre.

The only record of manuring prior to the commencement of the experiment is an application of a complete mixture about 10 years before 1937. Both fields have since been manured regularly with nitrogen and phosphate or a complete mixture under an annual or biennial scheme of manuring. 30 lbs. of nitrogen and 5 to 10 lbs. of phosphate per acre per annum, together with a small proportion of potash in recent years can be taken as average quantities applied over the 10-year period.

The resting of trees for 3 to 4 weeks during the annual period of refoliation has been followed according to the Ceylon custom, except for one year during the war so that the tapping year consists of about 11 months, the periodic systems of tapping being adjusted to fit in with the tapping year.

Layout.—A randomised block arrangement has been adopted for 11 tapping systems with 6 replications. The unit plot consists of 30 trees For convenience of tapping arrangements the systems of tapping have been grouped into 6 two-day series and 5 three-day series, which form sub-blocks within the main blocks, the two series being randomised independently within each sub-block, while the sub-blocks themselves are separately randomised in pairs within each block. The significant differences between the various systems, therefore, differ slightly according to whether the comparison is made within sub-blocks or between sub-blocks

Yield Recording.—Each tapper collects his own latex from the trees tapped each day in the requisite number of buckets. The latex is weighed in the factory and the dry rubber content is determined by trial coagula-

tion of a 50 c.c. sample from each bucket which gives the percentage d.r.c. figures. Scrap is collected, dried and weighed separately. Experimental records of yields are taken only on normal tapping days, that is, on days when the yields are not affected by rainy weather.

Height of Tapping Cuts.—It is known that the yields on seedling trees vary considerably according to the height on the tapping panel. The differences in yield when tapping at the base of a tree and at a height of 35 to 40 inches can be as much as fifty per cent due both to the yielding capacity of the tissues at various heights and the circumference at the tapping height.

Ideally new cuts should be opened depending on the bark consumption of each tapping system so that the cycle remains the same for all treatments. Owing to the higher rates of bark consumption in the past and the presence of immature bark, it was not possible to carry this out on old seedling rubber at Dartonfield.

In this experiment the tapping was started on the existing cuts and new cuts were opened at 27 and 30 inches according to the bark consumption of the milder or the more intensive systems of tapping. No special provision was made for the very high bark consumption of the "double three" system (No. 8). This may partially account for the change in the general trend of increased yields of this system about the 8th year when a high proportion of new cuts were opened at 30 inches. The average height of tapping cuts are given in brackets in Table I, and it is evident that the periodic systems at this stage have a slight advantage on height of cuts.

Results

The results are presented as in previous years. Table I gives the preliminary yields of the experimental plots recorded for 10 months in 1936-37, and the experimental yields for 1946-47 in kilograms per plot of 30 trees. The table also, includes the experimental yields adjusted for differences between plots found in the preliminary yields. Table II gives the yields for 10 years expressed as a percentage of the control system No. 1, S/2, d/2, 100%, and the average percentage figures for the 10 years tapping.

The control system No. 1 has given 66.6 kilograms per plot in the 10th year of experimental tapping which is below 500 lbs. per acre. This may be partially due to the age of the trees which are now about 30 to 35 years old. The year 1946-47 shows poor yields generally over the whole estate.

In 1946-47 tapping systems Nos. 2, 6, 7 and 9 have each given over 80 per cent of the yield of the control system S/2, d/2, 100%. For the 10 year period the average yield is about 80 per cent of the control. The benefits of the periodic rest is evident after 2 to 3 years' tapping on the reduced intensity with corresponding advantages in tapping costs. Continuous tapping on systems No. 7, S/2, d/3, 67%, has given as good yields as the periodic resting systems, and system No. 9 sometimes known as the Sunderland system with 6 months' tapping and six months' rest is the cheapest as shown in Table IV. At present, however, with certain grades of manufactured rubber fetching considerably higher prices than standard grades a nett loss of 20 per cent crop on reduced intensity will certainly outweigh the advantage of a saving in tapping costs.

System No. 3, which is the half-spiral alternate day on alternate sides is somewhat similar to the double-four, in that each cut is tapped once in 4 days. The yields have been apparently higher than those of the control

over the 10-year period and the average of 9.2 per cent over the control is not far below the required standard of significance. This system compared with the double-four has apparently given higher yields, but it has not the same advantage in tapping costs. A trial of this system on estates may prove advantageous in the wet low-country districts.

System No. 4.—Two quarter cuts in echelon on alternate days has no special advantages to offer, when compared with the other 100 per cent systems both for yield and tapping costs. There is always the practical difficulty of marking the two quarter cuts correctly spaced, on trees already tapped for a number of years, especially the left quarter cut, when a new panel is commenced.

System No. 5.—The double-four has given an apparent increased crop of 4.5 per cent over the control alternate day, half-spiral system for the 10-year period. From general experience this system can be expected to give somewhat higher yields than the control, and double-cuts on a smaller task afford a means of quicker collection of latex during showery weather. The relatively low tapping costs give the double-four an added advantage at the present time. The four-day interval is, however, not suited to the drier districts of Ceylon.

System No. 8.—The double-three was originally included in this experiment not for permanent adoption but as a suitable form of a more intensive system to be used on trees prior to replanting. Up to the end of the 7th year of tapping there is evidence to show that extra crop can be obtained from double-three tapping compared with the control S/2, d/2, 100% without any adverse effects under the conditions of this experiment. These results proved quite useful during the war period, when recommendations were made for the adoption of this system for obtaining extra crop irrespective of costs. In the 8th, 9th and 10th years of tapping the double-three has shown some signs of deterioration, the yields falling to the level of the control in 1946-47. This drop in yield cannot be explained by any disparity in the average height of tapping cuts given in Table I. The numbers of thin bark and dry bark trees given in Table VI are not excessive, when compared with the control. The very satisfactory dry rubber content figures in Table III, up to the end of the 10th year indicates that the yielding capacity of the trees has not been strained. As stated earlier with regard to the heights of tapping cuts it is quite possible that a drop in yield may be connected with immature bark as the tapping cycle allowed for this system, with its annual bark consumption of 9 inches, falls considerably short of the 9 years cycle allowed for the control. It seems, therefore, that there is no convincing evidence to prove that the drop in yield is the beginning of a real deterioration. The increased yield of nearly 16 per cent over the 10-year period remains statistically significant. From a point of view of tapping costs, the double-three does not have the same advantage as the double-four.

System No. 10 and 11, the shorter interval of periodic rest of 4 months in 12, with the double-three system has been more effective than 6 months in 18 for producing the better crop at the reduced intensity of 89 per cent with the advantage in tapping costs.

Tapping Costs.—It is difficult to keep accurate figures of tapping costs in an experiment of this nature, but it is possible to work out theoretical figures based on the relative yields of the various systems for the ten year period. It is assumed that the normal tapping tasks in Ceylon for single and double cut systems are 200 and 125 trees respectively per tapping day. Relative percentage tapping costs are given in Table IV. It is for estates to determine under their own conditions of manufacture,

whether the handling of extra bulk crop in their factories for the production of highly priced special grades at the present time will lower the overhead charges, so as to outweigh any increased costs incurred in producing the increased crop. There is always the possibility of reducing costs of tapping by a reasonable increase in the numbers of trees per task in Ceylon, depending on the stand per acre. The importance of providing a sufficient stand per acre of tappable trees in the future for economic tapping cannot be over-stressed.

TABLE IV

Relative Costs of Tapping

	Tapping Systems	Per cent
Sub-block A 2-Day Series	1. S/2, d/2, (2x6m/12), 100%	100
	2. S/2, d/2, (2x6m12), 12m/18, 67%	82
	3. S/2, d/2, (2x2d/4), 100%	92
	4. S/4//S4, d/2, (2x6m/12), 100%	97
	5. 2S/2, d/4, 100%	77
	6. 2S/2, d/4, (12m/18) 67%	67
Sub-block B 3-Day Series	7. S/2, d/3, (2x6m/12), 67%	82
	8. 2S/2, d/3, 133%	92
	9. 2S/2, d/3, 6m/12, 67%	67
	10. 3S/2, d/3, 12m/18, 89%	83
	11. 2S/2, d/3, 3m/12, 89%	75

Dry Rubber Content.—In Table III the dry rubber content figures have been summarised for the 10-year period. The figures for the various systems are satisfactory, and the differences found in certain years are not of any practical importance.

Bark Renewal.—At the commencement of the experiment it was decided to take bark measurements approximately at the same point and at the end of the 4th tapping year the increment rates of 1.0 to 1.5 mms. for the 4-year period in the various tapping systems were found satisfactory. It was not, however, possible to assess with any great accuracy the rate of increase with further measurements at the same point. From the 5th year onwards bark measurements of one year's renewal were taken for systems of 100 per cent intensity and over. Average figures of 5.5 to 7 mms. were obtained with no marked differences between the various systems of tapping. These figures were considered satisfactory. It should be remembered, however, that trees which have about 6 mms. bark in the first 12 months of renewal show an average of 9 mms. tappable bark after 9 to 10 years, and it would be almost impossible to trace the changes in bark thickness which involve the development and maturing of laticiferous tissues and the formation of new cork with the subsequent scaling off from year to year. Numbers of thin bark trees, which are indications of poor growth and development given in Table VI are not unduly high for all tapping systems. The highest number of 10 trees occurs in the double-three, out of a total of 180.

TABLE I

Mean Yield in Kilograms of Dry Rubber per Plot of 30 Trees *

	Tapping Systems	Preliminary yields 1936-37 †	Experimental yields 1946-47	Adjusted yields 1946-47	Scrap as per cent of total 1946-47
Sub-Block A. Two-Day Series	1. S/2, d/2, (2×6m/12), 100%	66·6	66·6 (11·9)	64·8	6·6
	2. S/2, d/2, (2×6m/12), 12m/18, 67%	60·9	54·5 (11·5)	56·6	6·6
	3. S/2, d/2, (2×2d/4), 100%	64·1	72·1 (14·3)	72·0	6·6
	4. S/4//S/4, d/2, (2×6m/12) 100%	63·9	57·8 (15·7)	57·9	7·8
	5. 2S/2, d/4, 100 %	67·8	69·1 (15·3)	66·5	7·1
	6. 2S/2, d/4, 12m/18, 67%	62·3	56·2 (10·9)	57·3	5·6
Sub-Block B Three-Day Series	7. S/2, d/3, (2×6m/12), 67%	63·3	65·7 (9·9)	66·1	5·7
	8. 2S/2, d/3, 133%	65·5	65·2 (12·8)	64·2	7·2
	9. 2S/2, d/3, 6m/12, 67%	59·0	56·1 (8·4)	59·5	5·5
	10. 2S/2, d/3, 12m/18, 89%	66·4	61·8 (11·9)	60·2	6·7
	11. 2S/2, d/3, 8m/12, 89%	63·6	60·7 (12·3)	60·9	6·2
	Mean	63·9	62·4	62·4	62·4
	Standard Error			3·5	
	Sign. diff. (odds 19 : 1)—				
	do *within* sub-blocks			10·0	
	do *between* sub-blocks			10·0	

* Approximate conversion to lbs. per acre (×7) † Ten months' tapping only.

Figures in brackets denote mean heights of tapping cuts in inches at the end of the 10th tapping year.

TABLE II

Adjusted Yields as Percentage of System No. 1

	Tapping Systems	1937/38	1938/39	1939/40	1940/41	1941/42	1942/43	1943/44	1944/45	1945/46	1946/47	1937/47
Sub-Block A Two-Day Series	1. S/2, d/2, (2×6m/12), 100%	100·0	100·0	100·0	100·0	100·0	100·0	100·00	100·0	100·0	100.0	100·0
	2. S/2, d/2, (2×6m/12), 12m/18, 67%	70·8	74·0	86·6	85·7	86·3	79·9	81·4	83.3	82·9	87.3	81·4
	3. S/2, d/2. (2×2d/4), 100%	110·4	108·6	109·3	111·6	105·9	114·4	105·5	108·0	107·7	111.1	109·2
	4. S/4//S/4, d/2, (2×6m/12), 100%	85·0	94·5	102·8	113·2	114·9	119·1	111·3	108·0	96·2	89.4	103·2
	5. 2S/2, d/4, 100%	96·8	105·7	107·4	115·2	106·9	112·1	105·6	100·5	94·4	102.6	104·5
	6. 2S/2, d/4 12m/18, 67%	73·2	74·2	86·5	86·0	78·4	78·3	77·3	78·1	85·0	88.4	80·1
Sub-Block B Three-Day Series	7. S/2, d/3, (2×6m/12), 67%	67·8	71·2	79·5	85·7	80·2	77·1	79·9	83·4	88·8	102.9	81·0
	8. 2S/2, d/3, 133%	112·3	111·6	123·4	122·9	128·5	126·5	120·6	111·4	101·8	99.1	115·8
	9. 2S/2, d/3, 6m/12, 67%	69·0	73·6	82·1	85·1	83·6	79·0	76·1	78·3	82·2	91.8	79·6
	10. 2S/2, d/3, 12m/18, 89%	75·8	77·6	94·7	85·8	86·6	90·7	86·2	86·8	80·6	92.2	85·5
	11. 2S/2, d/3, 8m/12, 89%	81·0	89·0	101·0	99·5	97·9	96·3	95·8	102·3	92·4	94·0	94·1
	Mean	85·6	89·1	97·6	99·1	97 2	97·6	94·5	94·3	92·0	96·3	94·4
	Standard error	3·4	3·8	5·1	5·4	5·0	5·5	6·4	5·1	4·8	5·4	4·4
	Sign. diff. (odds 19 : 1)											
	do *within* sub-blocks	9·5	10·6	14·4	15·1	14·2	15·6	18·2	14·2	13·4	15·4	11·1
	do *between* sub-blocks	10·5	10·5	17·4	17·6	16·1	20·3	18·0	13·1	12·4	15·4	11·0

TABLE III

Dry Rubber Content Per Cent

	Tapping Systems	1937/38	1938/39	1939/40	1940/41	1941/42	1942/43	1943/44	1944/45	1945/46	1937/47
Sub-Block A Two-Day Series	1. S/2, d/2, (2×6m/12), 100%	40·8	41·5	41·2	41·0	40·4	39·6	38·1	37·0	37·0	39·6
	2. S/2, d/2, (2×6m/12), 12m/18, 67%	40·5	41·4	40·8	40·5	40·0	39·3	38·7	38·0	37·4	38·9
	3. S/2, d/2, (2×2d/4), 100%	39·5	40·3	40·3	40·7	40·2	38·9	37·9	37·4	37·9	40·6
	4. S/4//S/4, d/2, (2×6m/12), 100%	40·8	42·2	41·6	40·9	39·8	38·5	37·2	36·6	37·5	40·3
	5. 2S/2, d/4, 100%	40·8	41·6	41·9	41·4	40·6	39·7	38·3	37·5	38·4	40·8
	6. 2S/2, d/4, 12m/18, 67%	40·9	41·3	41·3	41·3	40·6	39·7	39 0	37·9	37·7	39·6
Sub-Block B Three-Day Series	7. S/2, d/3, (2×6m/12), 67%	42·3	43·0	42·2	42·0	41·2	41·2	40·1	39·5	39·1	40·7
	8. 2S/2, d/3, 133%	40·6	41·0	41·1	41·3	40·2	38·8	37·0	37·6	37·9	40·8
	9. 2S/2, d/3, 6m/12, 67%	38·9	40·3	40·5	40·3	39·7	39·3	38·0	37·5	36·7	38·4
	10. 2S/2, d/3, 12m/18, 89%	40·1	40·8	40·5	40·7	39·6	39·1	37·4	36·6	36·7	39·4
	11. 2S/2, d/3, 8m/12, 89%	39·0	40·0	40·4	40·0	39·4	39·0	37·5	36·3	36·6	39·7
	Mean	40·5	41·2	41·1	40·9	40·2	39·4	38·1	37·4	37·5	39·9
	Error	0·51	0·46					0·47	0·53	0·55	
	Sign. diff. (19 : 1 odds)										
	do *within* sub-blocks	1·4	1·3	Not significant	Not significant	Not significant	Not significant	1·3	1·5	1·6	Not significant
	do *between* sub-blocks	1·4	1·4	,,	,,	,,	,,	1·3	1·5	1·5	

TABLE V

Number of Trees with Brown Bast

Tapping Systems	1938/39	1939/40	1940/41	1941/42	1942/43	1943/44	1944/45	1945/46	1946/47
1. S/2, d/2, (2×6m/12), 100%	6	6	4	6	5	3	7	14	7
2. S/2, d/2, (2×6m/12),12m/18, 67%	0	2	3	3	5	3	4	7	3
3. S/2, d/2, (2×2d/4), 100%	3	5	8	8	8	6	8	15	8
4. S/4//S/4, d/2, (2×6m/12), 100%	2	4	7	7	10	5	13	22	15
5. 2S/2, d/4, 100%	3	5	11	12	7	6	8	20	11
6. 2S/2, d/4, 12m/18, 67%	0	4	1	3	5	2	5	6	3
7. S/2, d/3. (2×6m/12), 67%	3	3	4	3	7	3	8	9	5
8. 2S/2, d/3, 133%	8	11	12	14	6	6	12	17	11
9. 2S/2, d/3, 6m/12, 67%	4	6	3	3	1	3	7	6	2
10. 2S/2, d/3, 12m/18, 89%	4	5	5	5	3	2	6	12	3
11. 2S/2, d/3, 8m/12, 89%	3	5	7	7	3	2	4	11	6
	36	56	65	71	60	41	82	139	74

TABLE VI

Census of Diseased and Damaged Trees

Tapping Systems	No. of Trees in tapping		No. of Trees out of Tapping									
	Brown Bast	As a % of Total	Brown Bast	As a % of Total	Dry Bark	As a % of Total	Thin Bark	As a % of Total	Total out of tap-ping	As % of Total in Tapping	No. of trees wind damaged*	As % of Total
1 S/2, d/2, (2×6m/12), 100%	3	1·7	4	2·2	15	8·3	7	3·9	26	14·4	15	8·3
2. S/2, d/2,(2×6m/12), 12m/18, 67%	1	0·6	2	1·1	5	2·8	—	—	7	3·9	10	5·6
3. S/2, d/2, (2×2d/4), 100%	2	1·1	6	3·3	16	8·9	3	1·7	25	13·9	16	8·9
4. S/4//S/4, d/2,(2×6m/12) 100%	5	2·8	10	5·6	18	10·0	5	2·8	33	18·3	20	11·1
5. 2S/2, d/4, 100%	1	0·6	10	5·6	10	5·6	7	3·9	27	15·0	12	6·7
6. 2S/2, d/4, 12m/18, 67%	1	0·6	2	1·1	2	1·1	2	1·1	6	3·3	10	5·6
7. S/2, d/3, (2×6m/12),67%	1	0·6	4	2·2	6	3·3	1	0·6	11	6·1	12	6·7
8. 2S/2, d/3, 133%	4	2·2	7	3·9	22	12·2	10	5·6	39	21·7	9	5·0
9. 2S/2, d/3, 6m/12, 67%	1	0·6	1	0·6	4	2·2	1	0·6	6	3·3	8	4·4
10. 2S/2, d/3, 12m/18, 89%	2	1·1	1	0·6	10	5·6	2	1·1	13	7·2	4	2·2
11. 2S/2, d/3, 8m/12, 89%	1	0·6	5	2·8	5	2·8	1	0·6	11	6·1	15	8·3

*Trees uprooted by a storm in June, 1945

Brown Bast Trees.—The total number of Brown Bast cases are given in Table V. A reduction in the cases of Brown Bast is mostly among the trees which are now being tapped on new cuts opened in healthy bark, although symptoms of Brown Bast still remain elsewhere on the tapping panel.

As in previous years a more detailed summary of trees in tapping and out of tapping are given in Table VI together with trees out of tapping for other causes. Trees tapped on a single cut, which are out of tapping for a part of the year either before or after the change over of tapping panels are recorded as out of tapping for Brown Bast. There is very little change in the total number of cases of Brown Bast, dry bark and thin bark trees compared with the previous year. It is clear from the total number of trees out of tapping in Table VI that the less intensive systems of tapping have resulted in a lower incidence of the various symptoms connected with high yields.

The Table also includes the number of trees uprooted in a storm for which the yields have been adjusted.

TWO INTENSIVE TAPPING EXPERIMENTS WITH UPWARD TAPPING

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IN a previous intensive tapping experiment described in this Journal (Sharp 1945) the double-one, double-two, double-three and double-four tapping systems were compared for a period of two years. After the experiment had lasted for 13 months the tapping cuts of the dry trees of the two more intensive systems were abandoned and new cuts were opened on virgin bark above the tapping panels and tapped upwards. Later, after the experiment had been in progress for nineteen months, these two tapping systems were again modified and trees which, though not completely dry, were yielding less than 10 gm. per tapping were also tapped upwards. At the end of the experiment it was concluded that higher yields would have been obtained in the plots tapped on the double-two system if upward tapping had been introduced earlier and on a larger number of trees.

Experiment A

In this experiment the double-two system, modified as in the last five months of the previous experiment, is compared with tapping systems in which upward and downward cuts are tapped on all trees from the commencement of the experiment. The number of trees available was insufficient to make possible a comparison of more than three tapping systems.

The trees tapped for two years on the double-three and double four systems in the previous experiment on Dartonfield Estate were used in this experiment. The tapping cuts were at various distances from the ground but not above 36 inches.

Tapping Systems.—The following tapping systems were compared :—

System 1.—Tapping was continued on the previous cuts. In addition, two half-circumference cuts on opposite sides of the trees were opened on virgin bark just above the old tapping panels and tapped upwards. The trees were tapped daily, the upper cuts one day and the lower cuts the next (2S/2, d/1 (2×d/2) 400%.

System 2.—Similarly to 1, but the trees were tapped on alternate days and the tapping cuts every fourth day. 2S/2, d2 (2×2d/4) 200%.

Systems 3.—(Control) Double-two. Two half circumference cuts on opposite sides of the trees tapped on alternate days. 2S/2, d/2, 200%. Tapping was continued on the previous cuts but when the yield fell below 10 gm. of dry rubber per tapping, upward cuts were opened and tapped in place of the lower ones.

Layout of the Experiment

A randomised block layout was adopted with nineteen replications, each plot consisting of eight trees. Nine complete replications consisted of trees which had previously been tapped on the double-three system, and nine of the trees previously tapped on the double-four. One replication consisted of a mixture of trees from the two tapping systems.

The trees were allotted to the different plots on the basis of the individual tree records for the month of November 1943 in a similar manner to that adopted in the previous experiment.

Recording — was by cup coagulation. The samples were collected at the end of each month, dried for ten days in the smokehouse, weighed and the weights corrected for moisture content.

Results

The experiment commenced in December 1944 and ended in November, 1945. The trees were not rested during the wintering period. The yields are presented in Table 1, that of the control in pounds per acre and those of the other systems as a percentage of the control.

In the two columns on the right of the table are given for comparison the yields of the double-one and double-two systems of the pevious experiment during the first year when upward tapping was not in use.

Tapping System No. 3—Double-two 2S/2, d/2, 200% Control

This tapping system yielded about 20 per cent or 190 lbs. per acre more than did the double-two system (with downward cuts only) during the first year of the previous experiment. About 40-50 lbs. of this is due to three of the five tasks of the previous experiment having been rested for four weeks during February and March and part of the remaining difference may be due to climatic conditions; but it seems likely that part must be attributed to tapping upwards on those panels on which the yield fell below 10 gm. per tapping. By May, 1945, 40 per cent of the trees were being tapped upwards and 75 per cent by the end of the experiment.

Tapping System No. 2—2S/2, d/2 (2x2d/4) 200%

The yield during the first six months exceeded that of the control by 19 per cent and was equal to the control during the second half-year. The failure to maintain the early advantage can be attributed to the larger proportion of trees in the control plots tapped upwards during the second half-year.

TABLE I

Experiment A—Yield of Control System in lb. per acre and of other treatments as a percentage of the Control

Months	Control Double-two 2S/2, d/2, 200% Yield lb. p. acre	System 1 (2S/2, d/1 (2xd/2) 400% Yield as% of control	System 2 2S/2, d/2 (2x2d/4) 200% Yield as% of control	Previous Experiment	
				Control. Double-2 2S/2, d/2, 200% Yield lb. p. acre	Double-one 2S/2, d/1, 400% Yield as % of control
December ...	134·8	161	108	97·9	161
January ...	113·2	171	127	100·3	141
February ...	75·4	171	119	50·8	126
March ...	92·9	152	123	71·5	137
April ...	69·8	140	115	85·2	125
May ...	65·4	153	124	65·9	111
Total 1st half year ...	551·5	158	119	471·6	136
June ...	76·3	116	100	61·9	110
July ...	98·7	105	105	90·3	103
August ...	82·7	117	102	67·1	103
September ...	78·1	105	104	81·2	104
October ...	93·2	105	94	40·7	109
November ...	111·1	109	95	89·4	109
Total 2nd half year ...	540·1	109	100	430·6	106
Total Whole year ...	1091·6	135	109	902·2	122
Significant difference (12 months) ...					
P=.01 ...		15·6 %			
P= 05 ...		11·6 %			13·3%

Tapping System No. 1—Double-one 2S/2, d/1 (2xd/2) 400%

During the first half-year the yield of this system exceeded that of the control by 58 per cent compared with 36 per cent by the normal double-one in the previous experiment.

In discussing the Control System No. 3 it was suggested that the modified form of double-two used in Experiment A had probably given a higher yield than the normal double-two tapped on downward cuts only which was used in the previous experiment. If this is so the advantage of this system over the normal double-one is even greater than would appear from the figures given above.

During the second half-year the excess over the control dropped to 9 per cent, an insufficient amount to justify the increased cost of tapping. These increased yields for the whole tapping year were obtained without any increase in the total cost of tapping and therefore with a considerable decrease in the cost per pound.

Experiment B

It is clear that there would be a considerable economy in tapping costs if, instead of tapping the upward and downward cuts on different days, all four cuts were tapped on the same day.

In the field in which Experiment A was set up there were insufficient trees to test more than three tapping systems so that this possible saving in tapping costs had to be the subject of a separate experiment.

Site of the Experiment.—A 20-acre field of budded rubber, planted in 1928, at Nivitigalakele had previously been tapped on the double-three system for two years. The budded trees were planted in small mono-clone plots and consisted of clones made from high yielding trees on estates. None of these clones has any economic value and the field had been set aside for replanting.

Tapping Systems.—Two tapping system were compared

System 4.—The two existing cuts were kept in tapping and upward cuts were opened on virgin bark two inches above the top of the existing tapping panels. The upward and downward cuts were tapped on alternate days. Thus the tapping cuts were tapped on alternate days and the trees were tapped daily. 2S/2, d/1 $(2 \times d/2)$ 400%. (This is the same as System 1 in Experiment A).

System 5.—Similar to System 4 but all four cuts were tapped on the same day and the trees were tapped on alternate days 4S/2, d/2, 400%

Layout of the Experiment

Fourteen tasks of 100 trees were arranged in blocks of two tasks according to the yields obtained before the experiment started when tapped on the double-three system and the two tapping systems were allotted to the members of a pair at random.

In System 4 the whole task was tapped on one day and in System 5 the task was divided into two and the half tasks were tapped on alternate days.

Recording was by metrolac. The scrap rubber was not recorded.

Results

Tapping commenced in July, 1945. Owing to the heavy loss of trees from storm damage the experiment was stopped at the end of November, 1945.

The yields in lb. per task per tapping are given in Table II.

TABLE II

Experiment B — Yield in lb. per task per tapping

Block Nos.		Tapping System 4	Tapping System 5	Sign. diff. (P=.05
1	...	3.3	4.8	
2	...	4.3	4.6	
3	...	4.5	6.1	
4	...	4.2	6.1	
5	...	4.0	4.1	
6	...	4.4	4.9	
7	...	4.2	4.3	
Mean	...	4.1	5.0	.77
per cent	...	100	122	19

System 5 in which all four cuts were tappped on the same day yielded 22 per cent more than System 4.

The time that a tapper spends can be divided into tapping time and walking time. The object of tapping all four cuts on the same day is to reduce the proportion of time spent by the tapper in walking so that he can tap a larger number of cuts without increasing the total time of tapping. Alternatively, if the size of the task is not increased tapping should be finished earlier and a higher yield should be obtained.

In this experiment it was impracticable to increase the number of trees allotted to System 5 and the advantage of quicker tapping has resulted in a higher yield. It is uncertain whether the whole of the increase of 22 per cent in System 5 can be attributed to quicker tapping and it is possible that it is partly due to an advantage in the system of tapping itself. It will be necessary to settle this question experimentally. There can however be little doubt that System 5 is the better system of intensive tapping to adopt for short periods.

Conclusions

Experiment A has fully demonstrated that higher yields will be obtained if upward tapping is adopted at the commencement of slaughter tapping. This is most clearly demonstrated when tapping at 400 per cent intensity, though there can be little doubt that a similar advantage will be obtained at 200 per cent intensity.

It is also clear that when four cuts are opened it is an advantage to tap them all on the same day rather than two cuts on one day and two on the next.

The conclusion drawn from the previous experiment, that tapping at 400 per cent intensity is not profitable for more than six months is confirmed by Experiment A.

Reference

Sharp, C. C. T.—An Intensive Tapping Experiment.—*Combined First and Second Quarterly Circulars*, 1945.

THE 1947 OIDIUM SEASON AT DARTONFIELD

C. G. HANSFORD, *Mycologist*

PRIOR to the wintering of the trees no trace of active infection by Oidium was discovered on the estate. The only signs of the fungus were the remains of last year's leaf infections, which were found to contain no trace of the fungus in living condition. These old infections remained in a mummified state throughout the period under review until the leaves were shed in the normal manner. The fungus does not fruit on the fallen leaves. Therefore the new infections on the young foliage are not regarded as the result of spores (conidia) of the fungus being received from the old leaf infections on the same or neighbouring trees, and there is still a complete lack of evidence that the fungus is carried over from one year to the next on the leaves infected in the previous season.

Wintering of the rubber at Dartonfield commenced with the Clone RRI. 506 on the hill on January 6th, and neighbouring clones (RRI. 501, PB. 183) commenced large scale defoliation about 19-22nd January, which I am informed was 2-3 weeks later than usual on the estate, presumably due to the long continued rains of the N. E. Monsoon in December. By the end of the month the clones mentioned were practically bare, while RRI. 500, 501, had commenced to winter. Adjacent areas of TJ. 1, WLG. 259, HC. 28 and old seedling rubber had scarcely started wintering at this time. The lower parts of the estate had also not yet commenced large scale wintering, though scattered trees amongst the old seedling rubber were shedding their leaves. WLG. 259 was in full wintering by the following week, and about February 14th HC. 28, the last of the clones planted on the hills, had commenced rapid wintering, while leaf shedding had then become more or less general over the whole estate. The clones RRI. 520, 514, PB. 6/9 were particularly late in wintering and did not shed their leaves until about March 20th; by which time almost the whole estate had refoliated.

Refoliation of the clones followed much the same order as that of wintering, and no striking discrepancies in the length of time each tree remained dormant were noticed. The first two trees to refoliate belonged to clone RRI. 506, and were carefully examined at frequent intervals for signs of Oidium. The first colonies of the fungus were found on 7th February on these trees and also on some young foliage of trees of clone 520 that had not wintered, but had produced new whorls at the tips of the branches. At this stage Oidium was entirely confined to isolated colonies on the upper surface of the leaves, and by the following day were producing large numbers of conidia. All infected leaves had then passed the danger stage and did not shed afterwards, though the fungus spread over them and produced numerous small colonies on the upper surface. Up to 14th February there was a gradual spread of Oidium on to the foliage of all trees in a suitable reception stage but was still limited almost entirely to leaves which had passed through the bronze stage and become green. By this time the fungus colonies had become very numerous and up to 1 inch in diameter on many leaves of PB. 183, and RRI. 506 as well as on a number of early winterers amongst the seedling rubber. Practically none of the leaves attacked at this time were shed afterwards, though they showed numerous colonies of Oidium on both surfaces. During the latter half of February conditions remained similar, with the gradual increase of infection as measured by the number of colonies per leaf and also by spread to

other trees. The first signs of attack on younger bronze leaves, accompanied by some distortion and curling were recorded on March 1st, and a few days later it became evident that a more rapid and severe spread was liable to occur at any moment. By March 10th a large increase was noted on PB. 183 and WLG. 259, though by this time the foliage of these clones had become green and passed the danger period. On the other hand HC. 28 was now just refoliating with most of the foliage still bronze in colour and exposed to serious infection from all sides. Infection was quite heavy in this clone during the next 3 weeks but little leaf shedding occurred, and was limited to the lower and very unimportant side branches. In spite of the heavy infection little leaf curling was caused by the attack and the colonies of the fungus on both sides of the leaves were noticeably smaller individually than on neighbouring clones and old seedling rubber. Of the latter about 10 per cent eventually shed their young leaves as the result of the attack.

In the lower part of the estate the old seedling rubber showed great variation in extent of infection and resultant leaf shedding, and it was very noticeable that this was closely correlated with time of wintering — the early trees did not shed at all, while late winterers were completely defoliated. By the end of March it became evident that the danger period was almost over, though the clones RRI. 514, 520 and PB. 6/9 were still bare or just commencing to refoliate.

By 15th April most trees of PB. 6/9 had suffered one severe attack of Oidium and had shed their young leaves; a second refoliation was taking place and again showed severe infection with much distortion of the young leaves. These shed almost completely during the following fortnight, and a third refoliation commenced at the end of April and early May, which showed rather less severe attack and by the end of May the trees had retained a somewhat thin foliage which had passed through the danger stage. Similar conditions prevailed on the near-by clones RRI. 514 and 520, though on these the attack was slightly less severe and some individual trees were able to retain at least part of their foliage, though the leaves showed much distortion and damage. During April adjacent young trees of AV. 163, which did not winter at all this season, formed new whorls of foliage at the ends of the branches, and these young leaves suffered rather severely, a high proportion being shed. Young foliage on old seedling trees and also on self-sown seedlings in the jungle along water courses continued to show new infections of Oidium up to the end of May (at the time of writing). Meanwhile examination was continued of the colonies of Oidium formed on the leaves of the earliest wintering clones in February, and it was found that early in April degeneration of the fungus occurred, conidia no longer being formed on these old colonies. This was in part due to their becoming infected with the parasitic fungus *Cicinnobolus*. In general it can be stated that the active life of an individual colony of Oidium, as measured by the production of normal conidia, lasts about 2 to 2½ months, as a rough average figure, provided the leaf bearing the colony remains on the tree. If the leaf is shed, conidial production appears to cease within 24 hours.

On the whole therefore this season has been one of mild to medium *Oidium* attack, as measured by the leaf fall experienced, though there has been no lack of development and spread of the fungus, and on late wintering trees infection was severe.

Sulphur dusting was carried out over the whole estate on February 27-28, again on March 4/5th and repeated on late wintering areas on 17th, 21st and 26th March. In such a season in which most of the trees had successfully passed the danger period before severe infection occurred it is

difficult to assess any possible benefit resulting from the dusting operations. These may have saved a proportion of the old seedling rubber, but in view of the small proportion of these trees still in a susceptible condition it was felt that more frequent dusting was uneconomic, even if it could prevent leaf shedding completely.

Weather Conditions.—The period 14-25th January was dry, but thence until 3rd February there were afternoon and evening light showers of rain, with consequent high night humidity: minimum temperatures varied during this period from 70-73°F, rather too high for Oidium development in epidemic proportions. After 3rd February the rainfall for the month was limited to two very heavy storms of 2.46 and 3.16 inches on 19th and 20th so that for the remainder of the month moisture conditions were not very favourable for the fungus, though minimum temperatures ranged as low as 62°F. During March humidity conditions became more favourable for *Oidium* as frequent light showers were experienced during the month. The temperatures at night, however, did not descend so low as in February and were above 70°F. except for 68°F. on the 14th, yet in spite of these rather high temperatures the disease spread sufficiently to cause defoliation of trees whose foliage had been in a suitable stage in the first 10 days of the month.

In Malaya the view is taken that the comparative freedom from the disease there is due to high temperatures and low daytime humidities during the refoliation period: it is becoming evident here in Ceylon that of the two controlling factors humidity is by far the most important at least in the low-country, and that given suitable ranges of humidity for long periods, the fungus is able to cause important damage in spite of rather too high a temperature for its optimum growth. On the other hand in the more elevated areas of Ceylon the night temperatures will assist the fungus to reach maximum development, and experience over past seasons indicates that the disease is much more dangerous there and more difficult of control.

Nivitigalakele Results.—Wintering at Nivitigalakele followed roughly the same order of clones as that at Dartonfield, but in general 2-3 weeks later in the season. Detailed notes of the Oidium intensity on the very large number of individual clones represented at Nivitigalakele were not kept on account of pressure of other work on the very limited staff available. It was very noticeable that local conditions of soil and exposure influenced the date of wintering of the same clone in different clearings, and it is also suspected that as the trees get older wintering becomes delayed. Unfortunately in the conditions at Nivitigalakele these two effects cannot be differentiated.

Experimental Work.—It has been generally accepted in the past that *Oidium* may remain in a dormant condition in the buds of rubber trees, and that when these develop after the wintering period the fungus grows with them and is able to infect the young leaves on a major scale if conditions are favourable. To the writer this seems a doubtful theory, as if the fungus is able to exist as dormant vegetative mycelium in the buds throughout the year, with wet and dry periods intervening, there seems no reason why it should not be able to grow along the developing stems and leaves and cover them every year with its colonies. I have been so far completely unsuccessful in my attempts to discover any trace of such fungus growth on the developing shoots and foliage, and the first sign of infection has been detected when the young leaves are about one inch in length. No trace of infection on young stems at this stage has yet been seen in Ceylon, though at a later stage the fungus is able to attack the flowers and stems bearing them, killing them completely. There

is thus no inherent inability of the fungus to attack young stem tissues, and its absence from the developing branches appears to me to indicate its absence from the buds.

A test was made by enclosing some bare branches during January in cellophane bags with wire frames to keep these distended and allow of foliage development within. Unfortunately I yet have to discover a cement for these bags which will stand up to conditions here, and the heavy rainstorms of February 19-29th burst open most of the bags used. Two bags happened to have been placed on the first tree to refoliate in the whole estate, and by February 19th the leaves in these bags had reached about 4-5 inches in length. All leaves and shoots inside the two bags were completely free from Oidium, while every leaf on this tree outside the bags showed one to several colonies of the fungus. There is a possibility that conditions in the bags were too moist to allow the fungus to develop, being practically at saturation point throughout day and night, but on the face the evidence appears to indicate that the foliage within the bags was mechanically protected against infection from outside. The whole appearance of the colonies on the trees at this time indicated their independent origin from air-borne spores of completely unknown origin.

This experiment was repeated from March 19-April 9th on the very late wintering clones PB. 6/9, RRI. 514 and RRI. 520. Most of the bags were damaged by very heavy rainstorms and high winds during the Easter holidays. Examination on 9th April showed in every case that exposed leaves were developing young colonies, mostly about 4 days of age as judged from size and distribution, while leaves protected still by the remains of the bags were quite free from infection.

Further repetitions of these trials will be made during the year, by artificial defoliation of branches to determine whether *Oidium* remains in an active condition throughout the year and remains well distributed in the air, its apparent absence being merely a result of the absence of foliage in a susceptible condition.

I consider it now to be sufficiently established that the annual infection epidemic originates from outside the individual trees infected and that it is air-borne. In view of the comparatively large number of these colonies developing on the first trees to refoliate the spore content of the air at this time must have been quite large, even though its origin is still undetected. Once these original colonies have been formed, conidial production is very rapid and extensive from them and the early development of an epidemic is easily explained on this account, given favourable climatic conditions. At this stage the only possibility of control lies in protection of the foliage by sulphur dusting, which has now become a matter of routine on many estates, though others have hitherto not adopted it and in many years I am informed that these suffer comparatively little damage. In the Kalutara district it still appears to be debatable whether on balance sulphur dusting is economic over a long period of years, though in seasons of epidemics there is no doubt as to its value in minimising the damage. In other areas, and especially at higher elevations regular and frequent sulphur dusting remains an essential of rubber cultivation, and where efficiently carried out gives commercial control of the disease.

Oidium in other areas in 1947.—Owing to complete lack of transport it has not been possible for the writer to obtain firsthand knowledge of conditions outside Kalutara district. A visit was paid to Matale district at the beginning of February to ascertain whether there was any possibility of the infection there being imported by wind to the low-country rubber areas. It was found that the wintering there was even behind

that in Dartonfield and that therefore this possible origin of Oidium in Kalutara must be ruled out. Whether this applies to all other mid-country areas is not yet certain.

General.—Discussion with planters indicates that at present Oidium cannot be regarded as a serious menace to rubber in the low-country districts of Ceylon, and in point of fact a very mild attack is definitely good on balance as it controls the production of seed and hence reduces damage by Phytophthora late in the season. In the more elevated districts however, there is no doubt that Oidium is a major factor in production, and under present economic conditions there is little doubt that many estates in these areas will gradually go out of production and turn over to other crops in course of time. Even here, however, there is likely to remain a proportion of estates specially situated where Oidium control can be carried out efficiently and hence production be kept up to payable standards.

Looking farther ahead, the search for more resistant clones must be continued, but recent efforts to obtain a wide range of rubber material from S. America have been completely blocked by the attitude of the Governments there, who have absolutely prohibited the export of such material. Until such time as they can be induced to modify this policy, we can only continue our examination of clones and seedlings available in the East. In assessing the value of these in relation to disease control a distinction must be drawn between those varieties which tend to winter exceptionally early, and those which in spite of being late in wintering, appear to suffer much less leaf shedding than normal. Of the two types the latter on balance is likely to be of most value over wide areas as in some seasons the Oidium danger period may commence early in the wintering season and even early wintering clones might then suffer severely. Also if such clones were planted in valleys with better soil and water supply, their wintering might be delayed so much as to coincide with the danger period in quite a proportion of seasons. After the selection of suitable varieties of both classes for trial it is important that they be planted in many different places, before any general estimate of their advantages could be made and utilised as a basis for recommendations to estates. At the present time material for a crown budding experiment is planted at the R. R. S. estate at Hedigalla, which can be utilised later for a trial with clones of the two types indicated. Results from such an experiment would be of very limited value, even if averaged over many years, and replications of it will be necessary on other estates in widely separated areas. It is also known that as rubber trees get older the danger from Oidium attack seems to increase, but to what extent this view has resulted from comparisons between the old seedling rubber of Ceylon and the younger budded areas is not apparent.

Present evidence definitely indicates that the sooner the whole of the old seedling rubber in Ceylon is replaced by budded clones the better from all points of view, including control of Oidium. The seedling areas show such a wide range of types, and the wintering is spread over such a long period that some proportion of the trees is bound to suffer severely. It is obviously uneconomic to have to make repeated applications of sulphur to fields in which the majority of the trees have successfully passed the danger period, merely to save severe damage on 20 per cent or less of the late winterers. For this same reason polyclone blocks are also to be avoided and the policy should be adopted of planting the greater part of each estate with one or two clones in monoclone blocks. Then the wintering period is compressed and much more uniformity obtained; if dusting is necessary then it is required for large areas all at the same stage of refoliation and then entails a minimum of trouble

and expense. As in most seasons the late wintering trees tend to suffer severely, it is obvious that, other things being equal, there is a great advantage in choosing early wintering clones for planting. In this respect the high-yielding clone PB. 6/9 is likely to suffer in Ceylon severely from its very late wintering and liability to severe Oidium attack — this may outweigh any advantage it may possess over other clones in yield capability. With a market entirely dominated by outside sources of supply, it is imperative that Ceylon estates concentrate upon low costs of production per pound of rubber, and any avoidable expense should be minimised. To carry out such a policy involves the most careful weighing of the advantages and disadvantages of each class of planting material especially in view of the long life of the crop; estates have to suffer for many years for any mistakes made in planting.

THE MANURING OF YOUNG RUBBER

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THIS article is a review of the manuring experiments carried out on Young Rubber by the Rubber Research Scheme over the past eight years.

(A) Nurseries

Trials have been made at Nivitigalakele of the effect on nursery seedlings of sulphate of ammonia, nitrate of soda, ammonium nitrate, calcium cyanamide, saphos phosphate, superphosphate and muriate of potash applied every other month from shortly after planting to within three months of budding. One experiment on a gently sloping deniya where the general growth was fair (1.1 inch diameter at 1 inch above ground level after 14 months) showed slight improvement of foliage on the ammonium nitrate plots but none of the treatments brought about any girth increase. There was some evidence however that the application of nitrogen increased the number of successful buddings. The figures below give the successful buddings as a percentage of total buddings for each treatment.

Without nitrogen	With Nitrogen (standard rate)	With nitrogen (double rate)
41%	79%	78%

Phosphate and potash had no effect.

A second series of experiments involving the chemical fertilisers mentioned above and in addition bloodmeal and a proprietary organic mixture was put down on narrow platforms with a high gravel content. General growth was poor (1.0 inch diameter in 18 months) and there was no response to treatments. This may have been due largely to the unsatisfactory moisture conditions of the soil. On this gravelly soil an experiment involving the application at the time of preparation of the beds of 10 tons well-rotted cow manure and 450 lbs. saphos per acre gave the following diameter results 19 months after planting :—

No manure	Cow manure	Saphos	Cow manure plus Saphos
.82 inch	1.03	.96	1.07
	Significant difference		.20

General growth was poor (.97 inch in 19 months) but a considerable improvement resulted from the application of cow manure.

Summary of R. R. S. Recommendations.—Nurseries, especially those on eroded soil and those long established should be given a generous application of bulk manure plus a moderate amount of saphos when the beds are being prepared. An alternative would be to rest the nursery for a period and establish a green manure crop such as Crotalaria with the aid of a little saphos.

The green manure crop should be dug into the soil to a depth of one or two feet about two months before planting the seed. If the growth of the seedlings is backward an application of an inorganic mixture should be made some months after planting and this may be repeated if necessary.

(B) Planting Holes

Experiments comparing the use of different manures were carried out on replanted budded areas on two estates. A comparison was also made between filling the top half of the hole with near-by surface soil and replacing the excavated soil from which large stones had been removed. Summaries of girth in inches measured at 3 feet are given belonw :—

	Time since planting (months)	No manure	Green manure	Chemical fertilisers	Green manure plus chemical fertilisers	Compost	Cow manure
Estate A	24	4.4	4.4	4.3	4.3	4.4	4.6
Estate B	26	B 6.4	6.9	6.6	7.2	7.4	7.4

Significant difference (A) Not significant (B) 19 :1=.33 ; 99 :1=.44

	Excavated soil	Surface soil
Estate A	4.4	4.4
Estate B	6.6	7.2

The difference between treatments at B is not statistically significant.

On Estate A where the general rate of growth was slow, none of the treatments showed any response. On Estate B where the general growth was good a considerable response was shown by bulk manures. No significant advantage resulted from the use of surface soil.

On the same two estates a further trial was laid down comparing a proprietary organic mixture with a mixture of chemical fertilisers. A summary of the girth measurements is given :—

	No manure	Organic manure	Inorganic mixture	Inorganic mixture (split)	Time since planting
Estate A	6.9	6.6	6.9	7.0	31 months
Estate B	7.2	7.3	7.4	7.2	26 months

In the split treatment, the phosphate and potash were applied in the hole, the nitrogen was applied 2 months after planting. The amount of organic manure used was 6 oz., the amount of saphos in the inorganic mixture was 2.2 oz. None of the treatments showed a response.

A trial involving saphos phosphate and muriate of potash was put down on a steep new planting of budded stumps. The fertilisers used per hole were 3½ oz. saphos and 2 oz. muriate of potash. General growth was somewhat poor. Girth measurements four years after planting showed a significant response to phosphate but none to potash.

General Mean	Response to phosphate	to potash	Significant difference (odds 19 :1)
10.47	.70	.06	.55

The variation in the response to phosphate, significant in this experiment but lacking in the estate trials (A and B) may be due to the difference between the amounts of fertiliser applied.

Summary of R. R. S. Recommendations.—The addition of bulk manure mixed with the soil in the planting hole is recommended. If green manure is used this should be added about 2 months before planting. The use of soluble fertilisers is not advised because of the possibility of loss by leaching. An application of a moderate dose of saphos mixed with the soil in the upper part of the hole is recommended.

(C) Young Clearings

An experiment covering 19 acres of replanted budded Rubber and containing 6 clones was laid down on Dartonfield in 1938. Treatments consisted of control, ammonium sulphate (N), Saphos phosphate (P) and Muriate of potash (K) alone and in combination. A compost treatment was also included. Trees were first taken into tapping in March, 1944 at 18 inches girth but only in those plots where the average girth was 17.5 inches or more and further suitable trees have been taken into tapping at 6-month intervals. Girth measurements in inches at 3 feet above the union were taken in June 1943, 5 years after planting and 9 months before trees were first tapped and a summary is given below :—

O	N	P	K	NP	NK	PK	NPK	Compost
12.9	12.9	14.9	12.9	15.9	14.0	15.9	16.1	15.8

A comparison between all treatments given a particular fertiliser with those not given that fertiliser showed responses as follows :—

	Response to N	P	K
General Mean	N	P	K
14.6	.5	2.5	.6
Significant Response (19 :1 odds			.84
(99 :1 odds			1.13

In June, 1945 and June 1946 girth measurements were made at 4 feet in order to avoid the tapping panel The response to each fertiliser treatment for the 12 months was calculated and a summary is given below :—

Average increment	Response to N	P	K
3.0 inches	.2	nil	nil

The 1944 measurements show a significant and considerable response to phosphate but only small and doubtful responses to nitrogen and potash The taking of trees into tapping at different times may be expected to

exert a disturbing influence on the rate of girth increase, but there is a strong indication from the yearly increment figures that the phosphate effect ceases about the sixth or seventh year.

The figures for trees in tapping for each treatment in March 1944 and October 1946 are given below as a percentage of the total trees in a particular treatment.

	O	N	P	K	NP	NK	PK	NPK	Compost
1944	nil	nil	7	8	45	21	47	36	48
1946	86	81	93	70	95	90	98	93	93

Trees are tapped on the alternate day half-spiral system (intensity 100%) but only one tapping per month is recorded for experimental purposes Scrap is not included. The total annual yields from the experimental records have been converted to pounds of dry rubber per acre on the basis of 150 tappings per year and 115 trees per acre. A summary of the results is given below for each treatment :—

	1944	1945	1946	Total
O	9	171	459	639
N	8	135	377	520
P	86	332	605	1,023
K	28	103	340	671
NP	192	407	638	1,237
NK	82	227	526	835
PK	197	375	603	1,175
NPK	162	398	622	1,182
Compost	183	359	528	1,070

The additional dry rubber obtained over the 3 year period as a result of manuring was :—

N	P	K	NP	NK	PK	NPK	Compost
—	384	32	598	196	536	543	431

The basic amounts of fertiliser applied per acre since planting were :—

Compost	Ammonium Sulphate (N)	Saphos (P)	Muriate of potash (K)
24 tons	1,387 lbs.	985 lbs.	496 lbs.

The treatments involving combinations of chemical fertilisers can be calculated from the above. The cost of fertiliser varied over the period. Costs in rupees per acre for the period of nine years are given below based on prices in 1937 and in 1947.

	N	P	K	NP	NK	PK	NPK	Compost
1937	81	31	30	112	111	61	142	120
1947	203	73	82	276	285	155	358	144

Transport and application costs have not been included owing to their wide variation but it should be noted that these will greatly increase the total cost of the compost treatment when compared with chemical fertilisers.

Measurements of bark thickness of all trees were made at 37 inches above the union, 5¾ years after planting and just before the first trees were taken into tapping.

Treatment	O	N	P	K	NP	NK	PK	NPK	Compost
Bark in millimetres	5.7	5.5	6.1	5.5	6.0	5.8	6.1	6.0	6.1

The small but significant differences show a response to phosphate but none to nitrogen or potash. From a study of the results of this experiment bark thickness shows a direct relationship to girth and is probably another indication of the better general growth resulting from the use of phosphate. Measurements of bark renewal for one year have also been made. As renewal took place over different years due to trees coming into tapping at different times it is not possible to give a summary of the figures for different treatments. There are indications of a considerable variation among clones a smaller variation among seasons but no clear indication of any differences between fertiliser treatments.

It is too early in the tapping history of the clearing to draw conclusions about the effect of fertilisers on the incidence of brown bast but the following figures may be of interest. The percentage of trees treated for brown bast in 1945 and 1946 is given for each treatment. The total trees in tapping in each treatment are given in the two bottom rows.

Treatment	O	N	P	K	NP	NK	PK	NPK	Compost
Brown Bast % 1945	2	4	1	0	5	1	1	3	6
Brown Bast % 1946	0	1	2	1	2	0	0	5	7
Trees in Tapping September, 1944	7	8	50	13	70	36	58	72	58
Trees in Tapping October, 1946	83	78	89	67	91	86	94	89	90

The general level of brown bast in the clearing for the first three years of tapping has been low, about 3 per cent of the total trees in tapping. It is of interest even at this early stage to note that plots given saphos only although amongst the highest yielding have shown no greater tendency to brown bast than those given a "complete" manure. Plots given chemical fertilisers have shown no greater tendency than those given compost.

In 1944 and 1945 observations were made of the progress of wintering of individual trees and a summary is given in which the number of trees wintered by a given time is expressed as a percentage of the total trees in the particular treatment.

	O	N	P	K	NP	NK	PK	NPK	Compost
1944	40	41	42	67	24	37	34	26	33
1945	65	50	52	47	11	36	53	30	41

There are indications that the treatments NP, NK, NPK and Compost retard wintering. Observations made in 1945 showed that trees on these plots refoliated at a later date than trees on the other plots. In 1944 the clearing suffered rather badly from Oidium. Leaf fall was most severe in the NP, NPK and compost treatments. There is some evidence that nitrogenous manures by delaying refoliation may contribute indirectly to a greater incidence of Oidium.

Heavy potash manuring on this area also appears to have had undesirable results. In December 1944 a number of trees were showing symptoms of dieback. A count of such trees was made with the following results. (Figures refer to affected trees as a percentage of the total for each treatment).

O	N	P	K	NP	NK	PK	NPK	Compost
17	4	2	29	4	10	8	4	5

The figures indicate an unsatisfactory growth condition on the unmanured plots which is corrected by the application of nitrogen or phosphate but intensified by the use of potash.

In 1945, 20 per cent of the trees in clone W. 259 were found to be affected by bark canker. The distribution of the affected trees was as follows :—

O	N	P	K	NP	NK	PK	NPK	Compost
9	12	11	23	19	26	43	24	13

Treatments containing potash appear to have increased the number of affected trees. It should be noted however that the NPK ratio in this experiment is 1 :1 :1 whilst that in R215 mixture which is supplied under the rationing scheme is 2 :3 :1.

A series of eight experiments similar to that just described except that the compost treatment was omitted was started in 1938 on estates in the Kelani Valley, Kalutara and Ratnapura districts. At all centres a girth response varying from 0.7 to 1.9 inch was shown by phosphate and three of these reached the level of statistical significance. At three centres an additional response varying from 0.5 to 1.4 inch was obtained when NK were added as well as P and of these the 1.4 increment was significant. The mean girths in inches are given below for all treatments averaged over the eight estates. The average age of the clearings was 5 years and experimental manuring had been carried out for 4 years.

	O	N	P	K	NP	NK	PK	NPK
	14.9	15.4	16.1	15.1	16.1	15.4	15.6	16.3
Increase over Control	—	.5	1.2	.2	1.2	.5	.7	1.4

A manuring experiment similar to the above but including both compost and lime treatments was put down on a sandy deniya at Nivitigalakele. Basket plants were planted in September 1940. Manures were applied at planting and thereafter at 6 month intervals until August 1942. Lime was applied to half of each plot one month before manures were given. The basic amounts of manure per plant over the period were 22 oz. Sulphate of Ammonia, 12 oz. Saphos phosphate and 9 oz. Muriate of potash. The total compost applied was 39 lbs. per plant and the total lime 2½ lbs. Measurements of girth at 3 feet above ground level were taken in May, 1943 and a

summary is given below :—

O	N	P	K	NP	NK	PK	NPK	Compost
3.59	3.33	3.92	3.68	4.11	3.38	3.62	4.81	5.04

Significant difference (odds 19 :1) 1.13

NPK and compost show a significant response.

Lime	No Lime
3.69	4.19

Significant difference (odds 99 :1) .28

Lime has had a highly significant depressing effect on growth.

Growth has been poor due very largely to the difficulty of obtaining good drainage. Phosphate has proved the best single fertiliser, but on this type of soil it is advisable to give an NPK mixture or compost.

The greatest response of Budded Stumps to manuring was obtained on a 2-acre block on Dartonfield replanted and first given experimental manures in May 1939 but the conditions of this experiment were somewhat different from those obtaining in the experiments already described. The block comprised 7 replications of the treatments control, chemical fertilisers at single and double rates and a proprietary organic manure. The amount of manures applied per plant over the 4 years was :—

(1) Proprietary organic manure 5 lbs.

(2) Inorganic Mixture (single) 2 lb. Nitrate of Soda ; 20 oz. Concentrated Superphosphate ; 8 oz. Muriate of Potash.

(3) Inorganic mixture (double) Same as (2) but at double rates.

Two replications were on shallow soil overlying slab rock. General growth on these areas was poor and there was no response to manures. The other 5 blocks were on a deep gravelly clay soil of fairly steep slope where general growth was fair and the response to manures much better than usual. Although the inclusion of results from the 2 replications on shallow soil decreases the degree of response to manures they are included in the mean values given below in order to avoid any possibility of bias. The girth values 4 years after planting were :—

Control	Organic	Inorganic (single)	Inorganic (double)
8.8	11.3	10.8	10.5 inches

Significant difference (odds 19 :1) 1.7

All treatments show a significant increase over the control but there is no additional significant increase obtained by doubling the amount of inorganic fertiliser or by substituting an organic mixture for the inorganic. General growth on the control plots was rather poor but the mean increase due to manuring of 2.1 inches 4 years after planting is the greatest obtained in manuring experiments under the supervision of the Research Scheme. The manures applied were not those normally used : Sulphate of ammonia was replaced by nitrate of soda and saphos phosphate by superphosphate. The quantity of manure for the first year was spread over 6 applications instead of the usual two. Cover crop on the greater part of the block

was very sparse for the first two years thus reducing competition with the Rubber. The early poverty of the ground cover though not desirable — the early establishment and control of a leguminous cover is advised — is considered as a major factor in this response but the application of frequent small doses and the use of superphosphate and nitrate may also have been of importance.

An experiment on the optimum quantity of Saphos phosphate for young trees is in progress on a new planting at Hedigalla. No other fertilisers are used. The area was planted with Budded Stumps in May, 1944. For the two years prior to that and subsequent to the felling of the jungle, the land had been under food crops. Girth measurements were made at 3 feet 2½ years after planting and a summary is given below:—

Total Saphos per tree up to October, 1946	Nil	oz. 6	oz. 12	oz. 18
Girth in inches	5.75	6.38	6.50	6.75
Significant difference 19:1	.24			
99:1	.31			

Saphos has given a significant response and the highest rate has shown an additional significant response over the lower rates. The amount for the period according to R. R. S. Advisory Circular is 8 oz.

Summary of R. R. S. Recommendations.—The application of rock phosphate (Saphos) is recommended in amounts increasing with the age of the trees. On badly eroded soils or where the growth of the Rubber is poor nitrogen and a little potash should be added as well. Compost and cow manure are excellent and under certain conditions such as shallow soil on ridges have given better results than chemical fertilisers but are not recommended for extensive clearings owing to the expense. Judged on the results of R. R. S. experiments, proprietary organic manures have not justified their extra cost, but many estates have reported on their value in nurseries and in the planting hole. The early period — about the first five years — appears to be most important in the manuring of young Rubber. By that time the root system of the tree should be well enough established to allow cessation of manuring without any serious setback.

RUBBER SEED*

M. W. PHILPOTT, *Chemist*

DESPITE its valuable oil content the seed of *Hevea braziliensis* is normally looked upon as a waste product not worth the trouble and cost of collection. It is true that efforts were made to utilise rubber seeds during the slump of 1928-1931, but although 8,000 tons were exported from Malaya in 1926, only 350 tons were exported in the following year and none thereafter. The trade collapsed because the cost of collecting the seed was too high in relation to the prices of vegetable oils, which at that time were very low.

Today, supplies of oils and fats are insufficient to satisfy the world's needs and prices have consequently risen to high levels. In 1931-1932 the London price of linseed oil ranged from about £15 to £20 per ton: in July, 1946 it stood at £65 and then rose rapidly to £135 at which quotations remained until February, 1947. The latest market reports (March 1947) show that the price now stands at £200 per ton. With the prices of oilseeds correspondingly high it is suggested that the possibilities of marketing rubber seeds should be re-examined.

For those who would study in detail the applications and economics of the rubber seed there is a voluminous literature which was admirably reviewed in 1932 by Dawson & Messenger (1). This review summariises most of the information which was available at that time on the collection, storage and composition of the seeds (2, 3); the properties and industrial applications of the oil (2, 4, 5); and the agricultural value of the seed-cake (2). More recent analyses of the oil have been published by Jamieson & Baughman (6) and by Hilditch and his pupils (7, 8).

The oil itself is a drying oil inferior to but capable of being used as a substitute for linseed oil in the manufacture of paints. Its main defect is its high free acidity which somewhat impairs its drying properties. It is known however that this acidity is caused by biochemical changes which occur in the seed during storage and experiment has shown (9, 10) that its development can be prevented if the fresh seeds are heated to destroy the fat-splitting enzymes present in the kernels. There is little doubt that the preparation of rubber seed oil of a quality acceptable to paint manufacturers as a regular commodity is technically feasible (10).

Other applications for rubber seed oil include the manufacture of soap, linoleum and factice. Suggestions have also been put forward for using it as an edible fat.

The industrial utility of the product, therefore, is not seriously in question and we can proceed to consider the economics of collection and marketing.

Different observers have estimated the average number of seeds set by an adult rubber tree at 400 (Eaton) and at 6,000 (Macmillan). It is difficult to check these figures but 6,000 is almost certainly a gross overestimate and 400 is probably fairly near the truth. Any estimate must be treated with reserve however because the seed crop varies from year to year and depends largely on the incidence of pod diseases. On a conservative estimate the rubber seeds which fall annually to the ground in

* Advance copies of this article were circulated to estate agency firms in May, 1947.

Ceylon contain between 10,000 and 20,000 tons of oil, the present value of which, if it could be harvested, would be of the order of ten to twenty million rupees.

Of the total seedfall, of course, only a small fraction could be collected. When the economics of seed collection were studied in Malaya it was found that on estates with cover crops collection from the ground was impractical and collection from hilly ground was unpopular. Male adult labour, even at that time, was found to be too expensive and the work was usually done by women and children. When it is recalled that the terrain in Ceylon is more hilly than in Malaya and that more estates now than in 1930 maintain a thick cover of leguminous plants, it would appear that the prospect of collecting large quantities of rubber seeds is not promising. On the other hand the much higher prices now likely to be offered for rubber seeds should enable estates to pay attractive rates for collection.

How much seed can be harvested in Ceylon under present conditions and at what cost are questions which cannot at this moment be answered. Yet until this information is obtained the commercial possibilities of rubber seed can hardly be assessed with confidence. For this reason it is hoped that a number of representative estates will institute trial collections during the next (July-August 1947) period of seedfall.

Meanwhile we can at least form a rough estimate of the cost above which collection would almost certainly be unprofitable. With the Bombay price of crude linseed oil standing at more than Rs. 2,000 per ton it may be assumed that the value of rubber seed oil would be not less than Rs. 1,500. To produce a ton of oil the oil-expeller requires 6 tons of seed for which he would be prepared to pay, possibly, Rs. 1,000 delivered, or Rs. 850 ex-estate. The rubber grower could therefore afford to pay for seed collection about Rs. 140 per ton, or a little over 6 cents per lb. Since about 100 seeds go to the pound a labourer (at Rs. 1-40) would have to collect at least 2,200 seeds in a day or a child (at Re. 1) at least 1,500.

These are crude estimates and they leave no margin for profit or for the cost of sorting, bagging etc. It seems reasonably safe to conclude however that collection would be worth while if a labourer brought in 3,000 seeds in a day or a child 2,000.

On many estates, in a normal seeding season, these intakes could be exceeded without much difficulty, but whether labourers and children will be found willing in these times to undertake the work of collection, even if well paid, can only be determined by trial. It is understood that any seeds which may be collected during the coming season will be purchased by local oil-expelling firms if delivered at a suitable price, but estates are advised to make their arrangements for selling the seeds before undertaking collection on a large scale. Seed should be delivered as fresh as possible because, as has already been mentioned, the oil obtained from stale seeds generally has a high free acidity which is objectionable to the user. If in future years rubber seed collection should be expanded with a view to export, facilities will no doubt be set up for heat-treating the seeds before despatch in order to improve the quality of the oil.

Seed collection might well be encouraged on smallholdings where, as a rule, the land is relatively flat and devoid of ground covers. The sale of seed would provide a welcome seasonal addition to the smallholder's earnings and it is hoped that the Government Rubber Purchasing Depots will assist by organising the marketing of smallholders' crops.

We conclude therefore that the prospects of collecting rubber seed economically in Ceylon are reasonably promising and that the problem is worth studying because of the acute world shortage of vegetable oils and the high prices now prevailing for oil seeds of all kinds. Progress is impeded at present by the absence of reliable information on the cost of collection; and rubber producers are therefore urged to provide this information by making critical trials during the forthcoming seeding season. The data chiefly required concern the quantities of seed which can be recovered from an average acre of rubber land, and the cost of collection. Any results which estates can communicate to the Rubber Research Scheme will be utilised in discussing the exploitation of rubber seeds with the Colonial Products Research Council with which the R.R.S. is co-operating.

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DAMAGE BY RATS AND TERMITES TO YOUNG RUBBER

RECENTLY a number of enquiries as to methods of dealing with the above have been received by the Rubber Research Scheme.

We advised one planter who was much concerned with damage by rats in a clearing to try the effect of painting the trees with a paste of lime, ricewater, and Nicotine Sulphate (which is obtainable in Ceylon as a 40 per cent solution by various makers, including the "Black Leaf 40") The thin paste of lime and ricewater is first made up and then the Nicotine Sulphate added at the rate of about 2 ozs. per gallon. He reports that since this was done the trees have been left severely alone by the rats, which were apparently frightened off by the smell.

The question of termite damage is more difficult to deal with. In my African experience, in a country literally full of the most voracious termites in the world, only one instance of their attack on perfectly healthy plants was brought to my attention — this on my own rose trees! In this case no poison added to the soil around the plants, nor anything applied to the plants had the slightest effect, and the only remedy was to search out the active nests and either dig them out completely or destroy them by fumigation with either Cyanogas or Sulphur dioxide by means of the usual "White Ant Exterminator" apparatus.

In all other cases I have yet encountered termite damage on plants of any kind could be used as an indicator that something else was radically wrong with the plants, in most cases root diseases of various kinds. Normally therefore the termite can be regarded as a scavenger of moribund or dead tissues of plants, and their climbing up trees at certain times of the year to consume old scales of bark and lichen growths is an instance of their quest for such food. Having thus cleaned the trees they do not continue to feed on healthy living tissues, but merely abandon the tunnels already made. With this experience, any planter noticing termite damage in his young rubber should immediately suspect the presence of root disease, and if at all doubtful on this point, send samples, preferably of plants just becoming attacked by the termites to me.

C. G. H.

SHORTAGE OF SODIUM BISULPHITE

THE prevailing shortage of sodium bisulphite has led many estates to ask whether pale-coloured crepe can be prepared without bisulphite or with the aid of alternative chemicals. In reply to these enquiries two suggestions are offered; first, to conserve bisulphite by using minimum dosages, and second, to use sodium sulphite as a substitute.

It is common practice on estates to add more sodium bisulphite than is strictly necessary and it will often be found that the standard dose can be halved without serious detriment to the colour of the finished product. Crepe manufacturers are therefore advised to ascertain by trial the smallest amount of bisulphite that is required to produce rubber of reasonably good appearance. About 4 or 5 oz. to 100 lbs. of rubber will generally be found sufficient.

Sodium sulphite is reported to be more easily obtained at present than bisulphite. Like the latter it is capable of preventing discolouration in crepe by virtue of its sulphur dioxide content. Anhydrous Sodium Sulphite (the grade usually imported) is less active, weight for weight, than bisulphite and is usually more expensive. Unlike the bisulphite it has an alkaline reaction and consequently behaves as an anticoagulant; so that when bisulphite is replaced by sulphite it is necessary to increase the amount of coagulant by one-quarter to one-third. Those who use the method of fractional coagulation to produce very pale rubber will find that much larger doses of acid have to be added to form the first (partial) clot.

M. W. P.

POISONING OF RUBBER TREES WITH SODIUM ARSENITE*

THE recommendations made in this circular for destroying trees by poisoning with Sodium arsenite prior to replanting are based on the experience gained on a number of estates. A note is included on the influence that tree poisoning is likely to have on the incidence of root disease in the replanted stand and it is recommended that this note should be carefully studied before deciding whether to destroy the old stand by poisoning or by felling in the usual way.

Method of Poisoning

Remove a ring of bark at the most convenient working height, (*e.g.*, about 3 feet from the ground) by making, with an axe or 'parang,' two horizontal cuts 4 to 5 inches apart right round the tree, taking care not to cut deeply into the wood, and then striking the bark to loosen and remove it.

Removal of a ring of bark is advisable in the case of rubber trees and others which produce latex, because if this is not done the latex will flow into the cuts where it will coagulate and clog the wood vessels sufficiently to interfere with the absorption of the poison solution.

When the latex has ceased to flow, a girdle 'frill' is cut *directly into the wood* by downward strokes of a sharp axe making a series of overlapping cuts about 2 to 3 inches deep.

Some practice is required to make a continuous horizontal trough that will hold liquid but an intelligent labourer soon becomes skilled at this work and will complete the operation on a tree of average size in about five minutes.

In practice it is found that wastage of the poison solution can be considerably reduced by smearing mud just below the cuts to plug the vertical cracks, before adding the solution.

A labourer walking round the tree pours the solution into the frill from a suitable container with a long spout, such as a tin kettle made for the purpose.

Strength of the Solution

For large trees we recommend half-a-pint of a solution, made by dissolving 10 lbs. of sodium arsenite in one gallon of water (50 per cent by weight), equivalent to ½-lb. of sodium arsenite per tree; for smaller trees Half-a-pint of a solution of 5 lbs. of the salt in 1 gallon of water (33 1/3 per cent by weight), equivalent to ¼-lb. of sodium arsenite per tree, has given satisfactory results.

The use of hot water for dissolving the sodium arsenite saves time and ensures the complete solution of the salt.

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* Reprinted from Rubber Research Institute of Malaya Circular No. 23.

Results of Poisoning

It has been found in practice that death of the foliage is normally complete in about 3 weeks and that of the whole tree in 2 to 3 months.

Branch fall usually begins about 6 months after poisoning and is completed about 12 months later.

The tree trunks fall to the ground 1½ to 2 years after poisoning,

The best results have been obtained on warm sunny days when the upward flow of sap is greatest. Poisoning should not be undertaken during or immediately before wintering.

Cost of Poisoning

The cost of treatment including labour and poison for the two dilutions used, with sodium arsenite at $35 per cwt. and labour at $1.20 per diem is shown below :—

Dilution	½ pint per tree	Labour (task of 35 trees)	Total cost per tree
5 lb. per gallon	7¾ cents	3½ cents	11¼ cents
10 lb. per gallon	15½ cents	3½ cents	19 cents

Warning

Danger of Arsenical poisoning through negligence can be avoided if the following precautions are taken :—

(1). Preparation of the poison solution should be carried out under strict supervision.

(2). The labourers should be warned of the deadly nature of the poison and made to wash their hands and faces when they break off for meals and at the end of the day's work.

(3). All utensils that have contained the poison solution should be washed after use and the sodium arsenite powder and any solution left over locked up after the day's work.

(4). All empty drums should be destroyed to ensure that they are not used as water containers by the labourers.

Replanting after Poisoning of Old Stand:

Planting holes should be dug before poisoning the old stand of trees and the actual planting should be undertaken immediately after poisoning and before defoliation.

Records from two experiments on replanting after poisoning have shown that the damage from falling trees is small. None the less, as a precaution against future damage, it is recommended that the initial stand of trees be increased by ten per cent or rather more if the old stand of trees was high or the trees particularly well grown.

The risk of injury from falling branches during the first 6 months after poisoning will not be serious enough to interfere with the normal routine upkeep along the planting rows. The risk to labourers will be greater after that period especially if the trees are of large size and a

sudden storm causes many branches to fall simultaneously. For this reason it is sometimes necessary to postpone budding for 18 months after planting.

Note on Poisoning and Root Disease

Poisoning a tree infected with root disease will destroy the fungus. The diseased roots of a tree killed by poisoning will remain a source of infection in the soil until they have rotted away or have been removed by digging.

Apparently healthy stumps left in the soil are liable to become infected by *Fomes lignosus*. Since this fungus cannot normally attack dead trees poisoning with Sodium arsenite by hastening the death of the stumps reduces the change of infection. The objection to leaving poisoned stumps in the ground is that as a consequence of their presence the cost of treating root disease in the replanted stand may be increased by about 50 per cent for each point treated. Poisoning the old stand may not therefore prove to be cheaper than felling and stumping in fields where the incidence of root disease in the new stand is likely to be high.

If the old trees are frill-girdled and poisoned in the manner described above no further poisoning of the stumps is necessary. On the other hand, if the trees have been felled and it is desired to poison the stumps afterwards a different method of poisoning has to be adopted. Advisory leaflets giving details of this method may be had on application.

Planters are warned, however, that in these circumstances the sooner after felling that the stumps are poisoned, the better, and that poisoning the stumps some months or years after the trees have been felled will be quite useless as a means of reducing root disease.

A number of estates in Ceylon have recently made enquiries about this method of destroying old rubber in areas needed for replanting, and as in Ceylon there is little or no experience with its use, it is felt that it would be advisable to point out the risks involved. These are :—

(1) The danger that the poison may arrive in unauthorised hands and result in accidental or criminal poisoning. Estates must devise means of ensuring strict control of all issues of the poison. All vessels containing the poison solution should be specially marked and returned to store immediately after use. After the poisoning is completed they can be thoroughly scrubbed and then returned for other use.

(2) The risk of poisoning labour using the solution. All persons coming into contact with the poison should be most carefully instructed to wash thoroughly immediately work is finished, and their clothes as well if contaminated. Prolonged contact of the skin with arsenite may set up dermatitis.

(3) Very great care should be exercised to ensure that none of the poison is allowed to contaminate streams used for drinking purposes.

(4) *None of the wood from poisoned trees can be utilised as firewood* All will contain arsenic and the smoke from fires made from it will be poisonous; and liable to contaminate any food cooked upon such fires. This is an especially important risk under Ceylon conditions and very difficult to avoid.

Details of the method for using Sodium arsenite to poison rubber trees are contained in the above Circular No. 23 of the Rubber Research Institute of Malaya.

C. G. H.

MEETINGS

RUBBER RESEARCH SCHEME (CEYLON)

Minutes of the eighty-second meeting of the Rubber Research Board held in Room No. 202, Galle Face Secretariat, Colombo, at 2-30 p.m. on Monday, 11th November, 1946.

Present.—Mr. L. J. de S. Seneviratne, C.C.S. (in the chair), Mr. H. E. Peries, C.C.S. (Acting Deputy Financial Secretary), Mr. W. H. Attfield, Mr. Simon Abeywickrema, M.S.C., Hon. Mr. G. E. de Silva, M.S.C., Mr. C. A. C. Bowen, Mr. W. Neal de Alwis, Mr. W. P. H. Dias J.P., Mr. Noel de Silva, Mr. A. M. Clement Dias, Mr. F. H. Griffith, M.S.C., Mr. A. W. Harrison, Mr. R. C. L. Notley, Mr. F. A. Obeyesekere and Mr. E. J. O. Richardson.

Mr. M. W. Philpott, Acting Director, was present by invitation.

1. Minutes

Draft minutes of the meeting held on 17th July, 1946, which had been circulated to members, were confirmed and signed by the Chairman.

Arising out of the minutes it was reported that three firms had quoted terms for acting as the Board's rubber brokers. It was decided to accept the lowest tender, that of Messrs. Muller, Wright & De Mel.

2. Board

The Chairman referred first to the death of Mr. R. C. Kannangara who had served the Board for 10 years since the 26th June, 1936. Mr. Kannangara had made valuable contributions to the management of the Scheme and members would remember him as a man who could give hard blows and receive them without rancour. A vote of condolence was passed in the usual way.

The following changes in membership were reported:—

(a) Mr. R. C. L. Notley had been re-nominated as a representative of the Planters' Association of Ceylon for 3 years with effect from 28th July, 1946.

(b) Mr. C. A. C. Bowen had been nominated to represent the Rubber Growers' Association, in place of Mr. E. W. Whitelaw who had resigned, with effect from 17th July, 1946.

3. Visiting Agent

The Chairman reported that Mr. P. R. May had retired from Ceylon and had tendered his resignation as Visiting Agent. The Board confirmed the appointment of Col. K, D. H. Gwynn who had been acting as Visiting Agent.

4. Experimental Committee

Recommendations made at meeting held on 16th September, 1946:—

(a) *Estate Accounts.*—It was decided to continue to show basic wages and special allowance separately in the accounts.

(b) *Buildings.*—It was agreed that twin cottages of an approved plan should be provided for labourers and that the Experimental Committee should be authorised to use its discretion in regard to the choice of building materials

(c) *Schoolmaster.*—The Acting Director reported that he had been unable to get a schoolmaster for the estate school capable of teaching in Tamil and Sinhalese. The Board decided to appoint two schoolmasters, one for each language.

(d) *Estate Expenditure.*—Extra expenditure on certain estate buildings and roads had been recommended by the Committee. The expenditure was approved.

The Board approved without comment the other recommendations of the Committee.

5 Reports

(a) *Director's Reports for 1st and 2nd quarters 1946* — were adopted.

(b) *Inventory Report for 1945* — was adopted.

6. Research Programmes for 1947

It was noted that the Chemical Department would not function in 1947 as there would be no Chemist. The programmes were approved.

7. Accounts

(a) *Estate accounts for April and May, 1946* — were tabled.

(b) *Auditor-General's Report for 1945.*—The Chairman referred to the absence of criticism in the Auditor-General's Report. The report was adopted.

(c) *Contribution to London Advisory Committee.*—An annual contribution of £2,000 to the funds of the London Advisory Committee was approved.

(d) *Draft Estimates of Income and Expenditure for 1947* — were approved.

8. Staff

(a) *Mr. T. E. H. O'Brien.*—The Chairman read a letter from Mr. O'Brien thanking the Board for their generous treatment of him.

(b) *Appointment of New Director.*—Applications for the post of Director were considered and it was decided to offer the post to Dr. E. Rhodes.

By general consent the meeting was adjourned until 19th December.

RUBBER RESEARCH SCHEME (CEYLON)

Minutes of the adjourned eighty-second meeting of the Rubber Research Board held in the Board Room, Dartonfield Estate, Agalawatta, at 10-30 a.m. on Thursday, 19th December, 1946.

Present.—Mr. L. J. de S. Seneviratne, C.C.S. (in the chair), Mr. Simon Abeywickreme, M.S.C. Mr. C. A. C. Bowen, Mr. A. M. Clement Dias, Mr. W. Neal de Alwis, Mr. W. P. H. Dias, J.P., Mr. Noel de Silva, Mr. F. H. Griffith, M.S.C. and Mr. F. A. Obeyesekere.

Mr. M. W. Philpott, Acting Director, was present by invitation.

Apologies for absence were received from Messrs. H E. Peries, C.C.S. (Deputy Financial Secretary), A. W. Harrison, E. J. O. Richardson and W. H. Attfield.

1. Minutes

Draft minutes of the meeting held on 11th November, 1946, which had been circulated to members, were confirmed and signed by the Chairman.

2. Visiting Agent

The Chairman reported that Col. K. D. H. Gwynn had agreed to serve the Board as Visiting Agent.

3. Board

The Chairman read a letter from Mr. F. J. C. de Mel (representative of the L. C. P. A.) in which Mr. De Mel tendered his resignation as he was going to England.

4. Reports and Accounts

(a) *Acting Director's Report for 3rd quarter, 1946* — was approved.

(b) *Statement of Receipts and Payments of the Board for the 2nd quarter, 1946* — was approved.

(c) *Reports of the London Advisory Committee for Rubber Research* — were tabled.

5. Estate Items

Estimates and contracts for the following works were approved:—

(a) Felling and clearing at Nivitigalakele, (b) Extension to Hedigalla road, (c) Extension to Nivitigalakele factory, (d) Survey of Nivitigalakele.

Transport rates for 1947 were approved.

The sum of Rs. 12,000 was voted for the purchase of a new Storage Battery.

6. Staff

(a) *New Director.*—It was noted that Dr. E. Rhodes had accepted the post of Director.

(b) *Acting Botanist.*—The good work of Mr. C. A. de Silva during the prolonged absence of other agricultural officers was noted with appreciation.

(c) *Soil Chemist.*—It was noted that Dr. L. A. Whelan had returned from leave.

(d) *Estate Superintendent.*—The Chairman reported that Mr. G. P. N. de Silva had been granted part of his unexpended end-of-contract leave and that Mr. G. W. Aldridge had been looking over the estates during the Superintendent's absence.

(e) *Mycologist.*—It was noted that Mr. C. G. Hansford had arrived and had taken up his duties.

(f) *Botanist and Geneticist.*—As Dr. Asana was not available it was decided to offer the post of Botanist to Mr. I. B. Crockart. The appointment of a Geneticist was deferred.

(g) *Research Assistants.*—It was noted that candidates for these posts were not of a high standard. It was agreed that one post should be offered to Mr. Koelmeyer.

7. Students

It was agreed that students of the School of Agriculture in their last year of training should be permitted to study rubber cultivation at Dartonfield.

8. Smallholdings Committee

The recommendations of the Smallholdings Committee which sat on 27th November, 1946, were not approved. The Smallholdings Propaganda Officer was asked to furnish a memorandum on the matters discussed.

The meeting then terminated.

RUBBER RESEARCH SCHEME (CEYLON)

Minutes of the eighty-third meeting of the Rubber Research Board held in the Secretariat, Colombo, at 2-30 p.m. on Tuesday, 8th April, 1947.

Present.—Mr. L. J. de S. Seneviratne, C.C.S. (in the chair), Mr. H. E. Peries, C.C.S. (Deputy Financial Secretary), Mr. Simon Abeywickrema, M.S.C., Mr. Thomas Amarasuriya, M.S.C. Mr. W. H. Attfield, Mr. C. A. C. Bowen, Mr. Neal de Alwis, J.P., Mr. W. P. H. Dias J.P., Mr. A. M. Clement Dias, Mr. Noel de Silva, Mr. J. D. Farquharson, Mr. R. J. Hartley, Mr. F. A. Obeyesekere, Mr. R. C. L. Notley and Col. J. T. Young.

Dr. E. Rhodes, Director, was present by invitation.

1. Minutes

(a) *Minutes of last meeting.*—Draft minutes of the meeting held on 19th December, 1946, which had been circulated to members, were signed by the Chairman on signification of members' assent that they were in order.

(b) *Matters arising from the minutes* :—

1. *Dartonfield approach road.*—Reported that the road had been repaired by the D. R. C.
2. *Smallholdings Committee.*—Agreed that this matter be considered by the Director and his views placed before the Board for consideration at a later meeting.

2. Board

The following changes in membership were reported; the incoming members were welcomed and the outgoing members thanked for their services :—

(a) Mr. Thomas Amarasuriya, M.S.C., had been nominated as a representative of the State Council with effect from 15th October, 1946, in place of the late Mr. R. C. Kannangara.

(b) Mr. F. J. C. de Mel (representing the L. C. P. A.) had resigned and Mr. T. C. A. de Soysa had been nominated in his place with effect from 30th January, 1947.

(c) Mr. J. D. Farquharson had been nominated by the Planters' Association of Ceylon to act for Mr. F. H. Griffith during the latter's absence from Ceylon, with effect from 15th February, 1947.

(d) Mr. A. W. Harrison (representing the R. G. A.) had resigned and Mr. R. J. Hartley had been nominated in his place, with effect from 14th March, 1947.

(e) Mr. E. J. O. Richardson (representing the C. E. P. A.) had resigned and Col. J. T. Young had been nominated in his place with effect from 1st April, 1947.

3. Reports and Accounts

(a) *Acting Director's report for the 4th quarter 1946* — was adopted.

(b) *Statement of Receipts and Payments for the 3rd quarter 1946* was adopted.

(c) *Finance.*—The Scheme's finances were considered in relation to its programme of development, and the long-term position was noted.

The transfer to current account of two deposits amounting to Rs. 19,000 and the realisation of an investment of Rs. 50 000 were reported.

(d) *Estate Accounts June to December, 1946* — were tabled.

(e) *Supplementary Votes.*—A supplementary vote of Rs. 1,725 was passed to cover the cost of furniture for 5 newly appointed officers and equipment for the estate office and dispensary.

4. Experimental Committee

(a) *Membership.*—Mr. Thomas Amarasuriya was nominated to serve on the Committee during the absence of Mr. F. H. Griffith.

(b) *Recommendations made at meeting of 8th April, 1947* :—

1. *Visiting Engineer.*—The Visiting Engineer's annual fee was increased as recommended by the Committee.

2. *Estimates for labourers' cottages.*—Estimates for the construction of ten sets of twin cottages were approved.

3. *Junior Staff Water Tank.*—An estimate for enlarging the junior staff water tank was approved

4. *Planting 50 acres at Hedigalla.*—The recommendation that 50 acres be cleared at Hedigalla for planting the seedlings derived from the 1945 hand pollinations at Nivitigalakele was approved and the necessary vote passed.

(c) *Recommendations made at meeting of 16th September, 1946* :—

Workmen's Compensation.—The recommendation that the Scheme's insurance against accidents for which compensation is payable under the Workmen's Compensation Act should be extended to cover contractors' employees was approved.

5. Staff

(a) *Director.*—Reported that Dr. E. Rhodes had assumed duties as Director on 26th February.

(b) *Senior Staff.*—A sub-committee was appointed to consider the revision of senior staff emoluments.

(c) *Botanist.*—The sub-committee mentioned above was asked to consider the appointment of a second Botanist.

(d) *Geneticist.*—The sub-committee mentioned above was asked to consider the appointment of a Geneticist.

(e) *Smallholdings Propaganda Officer.*—An application from this officer for one month's vacation leave was approved.

(f) *Secretary-Accountant.*—Reported that Mr. C. D. de Fonseka, Secretary-Accountant, had returned from study leave and resumed duties on 28th February.

(g) *Research Assistants.*—Reported that the posts had been advertised for the third time but that no suitable applications had been received.

(h) *Junior Staff.*—A deputation consisting of three members of the Junior Staff presented their case for improvement of their salaries and terms of service. A Sub-Committee was appointed to consider the matter.

The meeting was then adjourned.

C. D DE FONSEKA,
Secretary-Accountant.

Minutes of the adjourned 83rd meeting of the Rubber Research Board held at the Secretariat, Colombo, at 2-30 p.m. on Monday, 12th May, 1947.

Present.—Mr. L. J. de S. Seneviratne, C.C.S. (in the chair), Mr. Simon Abeywickreme, M.S.C., Mr. Thomas Amarasuriya, M.S.C. Mr. W. H. Attfield, Mr. W. Neal de Alwis, J.P., Mr. W. P. H. Dias, J.P., Mr. A. M. Clement Dias, Mr. T. C. A. de Soya, Mr. Noel de Silva, Mr. J. D. Farquharson, J.P., U.P.M., Mr. A. D. Layton, Mr. R. C. L. Notley, Mr. F. A. Obeyesekere, and Col. J. T. Young.

Dr. E. Rhodes, Director, was present by invitation.

Apologies for absence were received from Mr. H. E. Peries, C.C.S. (Deputy Financial Secretary) and Mr. R. J. Hartley.

1. Minutes

(a) *Minutes of last meeting* — Draft minutes of the meeting held on 8th April, 1947, which had been circulated to members, were signed by the Chairman subject to the inclusion of Mr. T. C. A. de Soysa's name in the list of members present.

(b) *Matters arising from the minutes*:—

1. *Smallholdings Committee.*—The Director's memorandum regarding the work of the Smallholdings Department was considered and it was agreed that he should supply further detailed information regarding the work of the Rubber Instructors.

2. *Yield at Nivitigalakele.*—The Director's memorandum was considered and it was noted that the drop in yield was due partly to the change in tapping system and partly to the reinstitution of the winter rest.

2. Board

The Chairman reported that Mr. A. D. Layton had been nominated by the Rubber Growers' Association to act for Mr. C. A. C. Bowen with effect from 1st April 1947.

3. New Rubber Planting Scheme

At the request of the Director of Agriculture it was agreed that a short course of training in tapping be given to the Range Officers of the New Rubber Planting Scheme.

4. Publications

The following publications were tabled :—

(a) Annual Report for 1945.
(b) Combined Quarterly Circulars for 1946.

5. Staff

(a) *Senior Staff Salaries Committee.*—The recommendations of the Senior Staff Salaries Committee were adopted as follows :—

1. *Salaries of Senior Staff.*—Agreed that the war allowance payable to Senior Officers be increased by Rs. 110 per month.
2. *Botanist.*—Agreed that a second Botanist with a leaning towards plant breeding should be appointed.
3. *Secretary-Accountant.*—A new salary scale for the Secretary-Accountant was approved.

It was also agreed that a new contract be offered to Mr. M. W. Philpott, Chemist and that Dr. L. A. Whelan, Soil Chemist, be allowed to postpone his end of contract leave until February or March, 1948.

(b) *Junior Staff Salaries Committee.*—The report of the Committee was considered and its recommendation that salary scales should not be altered at the present time was adopted.

(c) *Changes in Junior Staff.*—Changes in the junior staff since the last meeting were reported.

6. Experimental Committee

(a) *Visiting Agent.*—It was noted that Col. K. D. H. Gwynn was unable to continue as the Scheme's V. A. and it was agreed that Mr. W. A. Paterson be asked to make a special visit to the Scheme's estates.

(b) *Gallawatta Chummery.*—Agreed that the tenancy of the Gallawatta bungalow be terminated and that the officers who now occupy it be housed in the new chummery at Dartonfield.

(c) *Secretary-Accountant's bungalow.*—An estimate for providing electricity, drainage and water-service to this bungalow was approved.

7. Reports and Accounts

(a) *Annual Report for 1946* — was adopted.

(b) *Statement of Receipts and Payments for the 4th quarter 1946* — was approved.

8. Colonial Office Scholarship Scheme

Details of the Colonial Office Scholarship Scheme for the training and subsequent employment of research officers was considered and it was agreed that the Research Scheme should not participate.

The meeting then terminated.

C. D. DE FONSEKA,
Secretary-Accountant.

London Advisory Committee for Rubber Research (Ceylon and Malaya).

Member nominated by the Colonial Advisory Council of Agriculture and Animal Health:

Sir Harold Tempany, C.B.E.

Member nominated by the Government of Ceylon:

Mr. L. Lord

Member nominated by the Governments in British Malaya:

Mr. J. Lornie, C.M.G.

Members representing Malayan planting interests—nominated by the Rubber Growers' Association:

Mr. P. J. Burgess (Chairman).
Mr. J. W. M. Kennedy.
Mr. Eric Macfadyen.

Members representing Ceylon planting interests—nominated by the Rubber Growers' Association:

Mr. G. H. Masefield.
Mr. George Brown
Mr. H. W. Horner.

Member representing Manufacturing interests:

Lieutenant-Colonel J. Sealy-Clarke.

Ex-Officio Members:

Sir H. A. F. Lindsay, K.C.I.E., C.B.E., Director of the Imperial Institute.
Professor V. H. Blackman, Director of the Botanical Laboratories, Imperial College of Science and Technology.
Dr. S. P. Wiltshire, Director of the Imperial Mycological Institute.
Dr. W. G. Ogg, Director of the Rothamsted Experimental Station.

Secretary:

Mr. J. A. Nelson, B.Sc.

The Technical Sub-Committee consists of members of the Advisory Committee with the following co-opted Members:

Mr. G. Martin (Superintendent of Rubber Investigations).
Mr. G. E. Coombs.
Mr. L. J. Bennett
Dr. Samuel Pickles
Dr. J. R. Scott
Dr. W. C. Davey
Prof. R. G. H. Clements

STAFF.

Mr. G. Martin, B.Sc., A.R.I.C., F.I.R.I.
Mr. H. C. Baker, M.Sc., A.R.I.C., A.I.R.I.
Mr. W. G. Wren, B.Sc., A.R.C.S.

RUBBER RESEARCH SCHEME (CEYLON)

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The Budding of Rubber. By R. A. Taylor, B.Sc., Physiological Botanist (out of date)
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